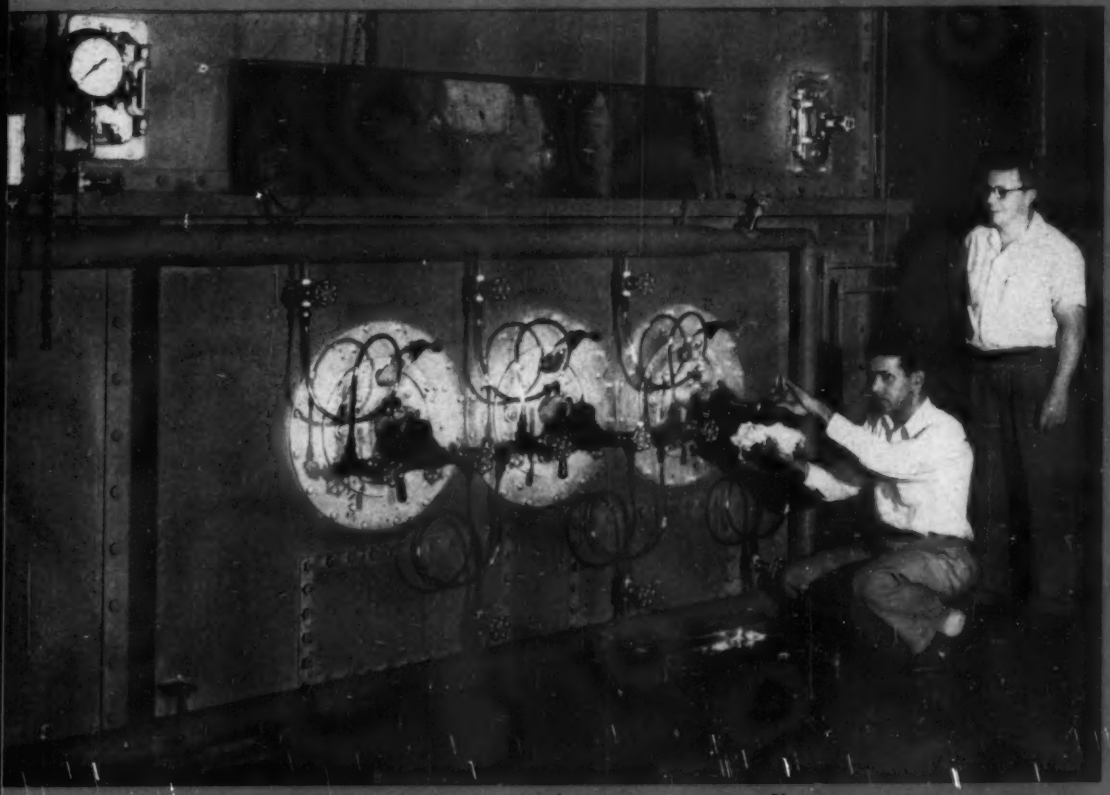
Heating Piping & Air Conditioning

DESIGN
INSTALLATION
OPERATION
MAINTENANCE

DECEMBER ★ 1931

INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

Page 103—Journal Section of The American Society of Heating and Ventilating Engineers



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Air Conditioned Office for Railroad 90
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EVERYTHING FOR PIPING

in 30 principal cities

with Grinnell jobbers in practically every city, coast to coast.

30 GRINNELL WAREHOUSES AND SALES OFFICES provide the products, facilities and experience gained during more than one hundred years of piping progress.

Grinnell Warehouses have been opened up in these twelve cities in the last five years

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DENVER	MILWAUKEE	SANTA BARBARA
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pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco humidification and cooling systems

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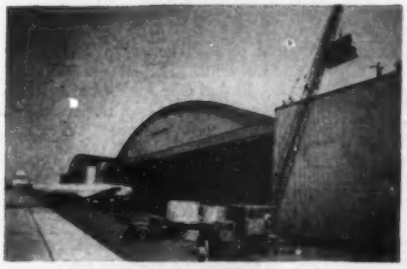
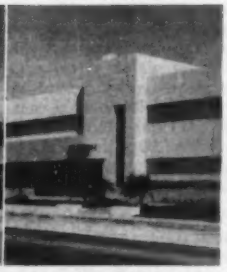
Restaurant



Airport Offices

Supermarket



Conference Room

Fits every Air Conditioning Need!

usAIRco Refrigerated Kooler-aire

Wherever there's a need for complete air conditioning, there's a place for a usAIRco Refrigerated Kooler-aire. This single compact unit cools, cleans, humidifies, dehumidifies and ventilates. With the addition of heating coil, it becomes a heating plant in winter!

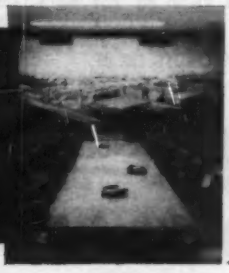
Oil Company Office

USES 95% *less water*

Compressor, conditioner and condenser come in this one package. This means tremendous savings in installation . . . no need of plumbing or extra wiring for roof tower. Evaporative condenser reduces water consumption as much as 95% . . . eliminates water disposal problems. Here are extraordinary values for specifiers and purchasers! Special units available for special needs.

usAIRco

Everything In Air Conditioning



United States Air Conditioning Corporation
3300 Como Ave. S.E., Minneapolis, Minn.

● Please send full information on your Refrigerated Kooler-aire.

Name_____

Firm_____

Address_____

City_____ State_____

THIS "Life Line" FORETELLS GOOD FORTUNE FOR YOUR PIPING

Every cost sheet today confirms the fact that the most expensive material you can use is that which must be replaced too soon . . . and too often. Premature pipe failure digs deep into your profit pocketbook—directly, through repair or replacements; indirectly, through production tie-ups and disrupted routine.

Users by the thousands have found the answer to lower maintenance in Byers Wrought Iron pipe. They have come to recognize its *red spiral stripe* as a dependable "life line" for predicting future service. They know that when corrosion is a threat to durability, Byers Wrought Iron pipe lives up to the prediction and pays-off in long, trouble-free service.

This time-tested material has rolled up impressive service records in a wide variety of applications. It is serving in thousands of snow-melting systems, of all sizes. Its mechanical strength and proved corrosion resistance make it the first choice for radiant heating systems. In steam and return lines, Byers Wrought Iron pipe has been remarkably effective in eliminating excessive repairs. It has successfully combated corrosive hazards in condenser services, air conditioning systems, underground lines, and sewage disposal plants. Many more services could be added to this list . . . but these will serve to suggest genuine wrought iron's many possibilities.

The next time you approve or specify pipe, investigate the superior performance of genuine wrought iron. You'll find it profitable to do so. For more facts on this time-tested material, write for our bulletin, THE ABC's OF WROUGHT IRON.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Division: New York, N. Y.

WHY GENUINE WROUGHT IRON LASTS

This notch-fracture test specimen illustrates the unique fibrous structure of genuine wrought iron—which is responsible for the high corrosion resistance of the material. Tiny threads of glass-like silicate slag, distributed through the body of high-purity iron, halt and disperse corrosive attack, and discourage pitting and penetration. They also anchor the initial protective scale, which shields the underlying metal.

BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

Heating Piping & Air Conditioning

Vol. 23, No. 12

DECEMBER 1951

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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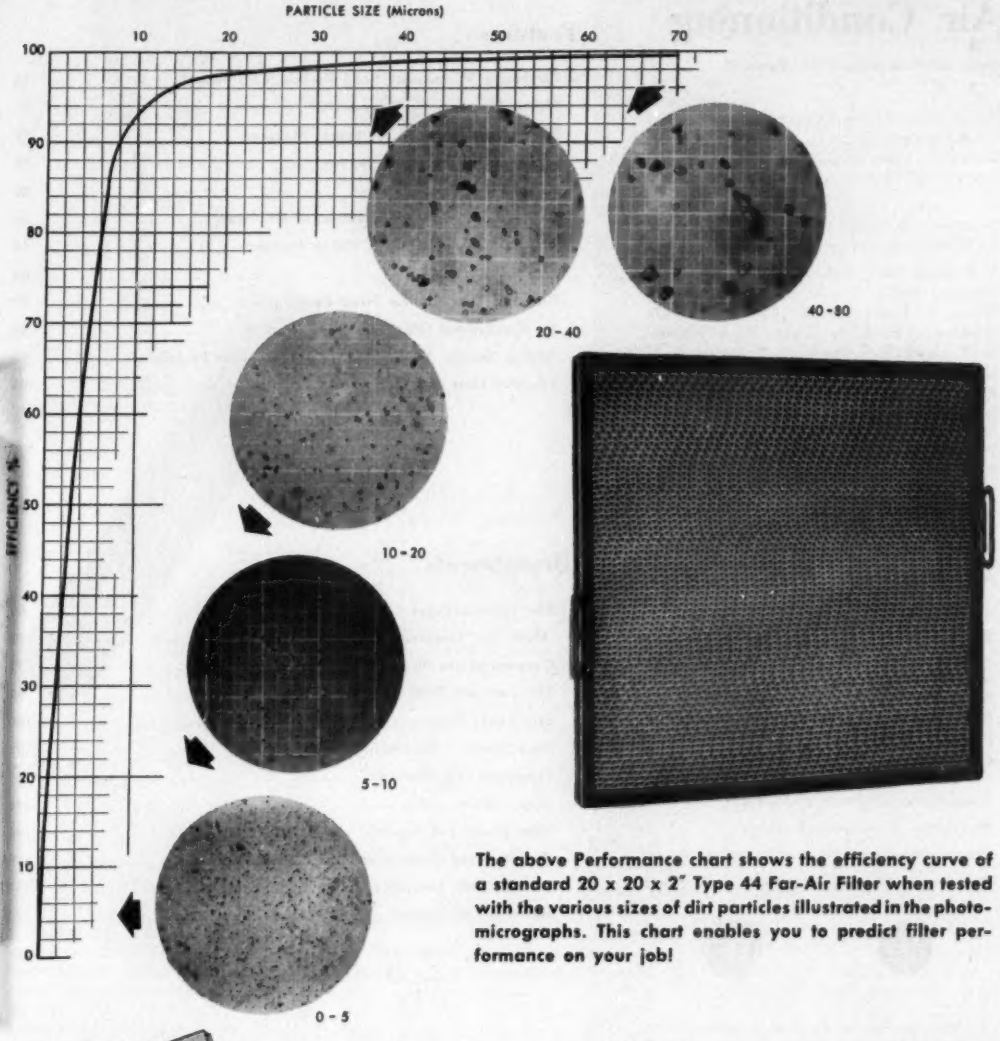
IMPORTANT NEWS FOR ARCHITECTS,



The above Performance chart shows the efficiency curve of a standard 20 x 20 x 2" Type 44 Far-Air Filter when tested with the various sizes of dirt particles illustrated in the photo-micrographs. This chart enables you to predict filter performance on your job!

FREE BOOKLET

Write today for your copy of the free booklet on the Farr testing procedures. This gives full technical information on the equipment used in these tests and the results obtained. Address: Farr Company P.O. Box 10187 Airport Station, Los Angeles 45, California.

ENGINEERS AND USERS OF AIR FILTERS

FAR-AIR* Offers You *Performance Rated* Air Filters

Greatly Improved Testing Methods Take the Guesswork Out of Air Filtration

Farr engineers, after years of research, have developed an improved method of measuring filter efficiencies. New applications of apparatus assure uniformity of air flow, dust feed rate, and sampling of the dust laden air ahead of and after the test filter. Improved test duct design has accomplished thorough dust dispersion and uniform dust distribution. Using test dusts of known chemical and particle size analyses in this equipment gives a more accurate evaluation of filter performance.

The reason for this change in testing procedures is the fact that all architects, engineers and reputable filter manufacturers know this important fact about air filters: *no filter—regardless of its design—operates at equal efficiency under all dust conditions.* For example, a filter may stop "gravel" with 100% efficiency, but may have 1% efficiency when exposed to dust particles of 0 to 5 micron size. (1 micron = 1/25,000 inch)

Filter Buyers Know This, Too...

Each user of air filtration equipment requires a different filter efficiency. For example, an electronics or watch manufacturer must have even the finest dust particles removed and knows he should buy the necessarily more expensive air filtering equipment to accomplish this. A department store, however, may not require the removal of ultra fine particles. By using the type filter which meets the efficiency requirements of the job, costs can be reduced. This is the reasoning behind FAR-AIR *Performance Rated* air filters.

Here's How FAR-AIR Know-How Can Help You

Through research and field experience Farr Company has built up a knowledge of practical solutions to many air filtration problems. These problems have involved many types of dusts in a wide range of concentrations and under varied conditions. Recommendations of our field service engineers can be of valuable assistance in helping you to properly solve your air filtration problems.

Farr Company Offers

full information on this radically improved filter testing procedure to all industries and filter manufacturers to further enhance the reputation of the air filtration industry as a source of reliably applicable information on its products.

FAR-AIR FILTERS

"Better by Farr"

*Trade Mark Reg.

FARR COMPANY *Manufacturing Engineers*

Los Angeles · Chicago · New York

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USE OF H. B. SMITH BOILERS BRINGS IMPORTANT SAVINGS WHERE RETAIL COMPETITION IS KEENEST

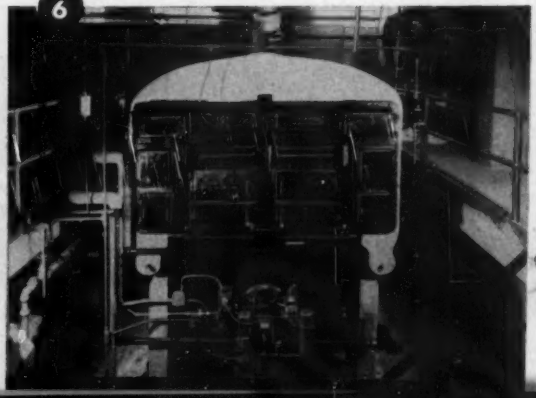
In order to offer values to their customers, retail merchants must obtain values from their suppliers. This simple rule of economics has prompted thousands of chain and independent retailers to install H. B. Smith cast iron boilers for heat and ample domestic hot water supply.

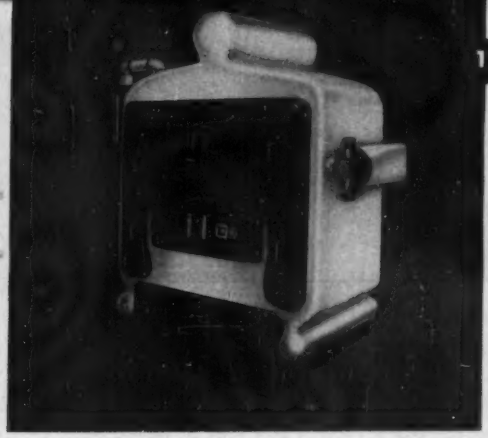
Cost Conscious Retail Chains Select

CAST IRON BOILERS FOR ECONOMY AND LONG-LIFE TOP PERFORMANCE

Howard Johnson's: Smith boilers are standard in the famous Howard Johnson restaurants and at its manufacturing plants. The boilers furnish warmth for the patrons, and the large volumes of hot water needed for cleaning.

F. W. Woolworth Co.: One of many installations. Low operating costs, an important item when selling mass-priced merchandise, has been an important factor in the decision to use H. B. Smith boilers.





M. N. Landeau, Inc.: The #34 Mills boiler is one of many installed in this progressive and growing chain of variety stores.

First National Stores, Inc.: Another famous food chain has seen the economies made possible with H. B. Smith boilers, and has specified them as standard equipment for its numerous retail outlets.

Successful retail store and restaurant management is at all times extremely conscious of overhead costs. In the selection of heating equipment, for example, far more than the initial cost must be considered, since annual fuel and maintenance bills greatly outweigh apparent "savings" in the original expenditure.

This composite town shows a few of the many successful chain store organizations that are using H. B. Smith boilers.

Not only do these efficient heating plants represent a moderate initial investment, but their fuel economy, unusually long life, negligible maintenance cost and ease of convertibility from one fuel to another accomplish tremendous savings in "cost of use."

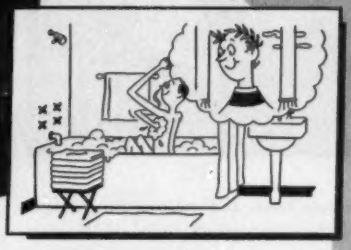
H. B. Smith boilers may be moved easily through existing entrances and assembled on the site. When replacing with Smith boilers, it is not necessary to make structural changes. Because of their compact size they require little boiler room space — free valuable basement area for storage, display or profitable sales.

The H. B. SMITH CO., INC. • Westfield, Mass.
— Established 1853 —

W. T. Grant Co.: Their largest store, at Syracuse, N.Y., is one of more than 200 Grant Stores using Smith-Mills boilers. The gas-fired #60 units deliver a total of 12 million b.t.u.'s per hour.

Friendly Ice Cream Corporation: A favorite "snack" chain in New England, these Friendly stores have their favorites too . . . in this case, Smith Boilers, which are standard equipment for heating the buildings and providing large amounts of domestic hot water.

McCrory Stores Corp. at Canton, Ohio, has these #44 cast iron boilers, fired by pressurized gas-burners. This organization, like many others, has standardized on Smith boilers throughout its far-flung chain of stores.



Even Caesar

would have cheered a bath like this...

THERE'S A REASON Next time you chuckle over one of these clever Statler cartoons in your favorite magazine, remember that there's a reason for the plentiful supply of hot water for the guest's bath:

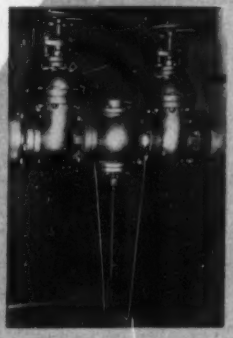
SARCO TEMPERATURE REGULATORS on all hot water heaters, as for example at this new Statler in Washington, D. C. These regulators include one 6", three 4" and one 3" Sarco Type TR-21.

For more than 25 years, Sarco self-operated Temperature Regulators have been used as standard equipment on storage type hot water generators.

For water always hot enough, never too hot, specify Sarco.

New bulletin No. 603 lists temperature controls for every type of water or oil heater.

Sarco Type TR-21 self-operated Temperature Regulator with flanged valve. Liquid expansion provides the dependable operating force.



Front of a horizontal storage water heater in the Hotel Statler, Washington, D. C., showing the 4" Sarco Regulator installed thereon. All five water heaters are equipped with Sarco Temperature Regulators.

SARCO COMPANY, INC.

EMPIRE STATE BUILDING, NEW YORK 1, N.Y.

SARCO CANADA LTD., TORONTO 8, ONTARIO

REPRESENTED IN PRINCIPAL CITIES

336

Sarcotherm
Modulating Heat Control

Selected for

SMOKE RISE
Luxury Homes

Ninety-one distinctive, custom built homes have been completed in this exclusive club development comprising 5000 acres of unspoiled country near Butler, New Jersey, 30 miles northwest of New York.

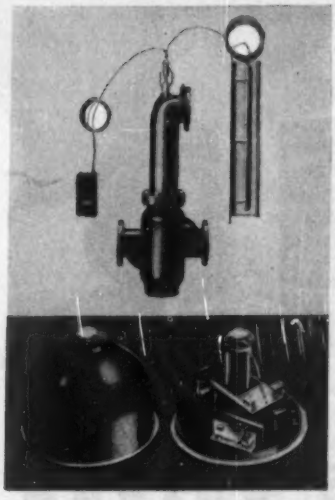
Prominent among outstanding modern improvements built in by the architect, Carl Kemm Loven, A.I.A., of Glen Rock, N. J., is the extensive use of

RADIANT HEATING

with Sarcotherm Control, thus assuring complete comfort for the occupants under all weather conditions.

For full information ask a Sarcotherm engineer to see you —there is one near you—or write for complete catalog.

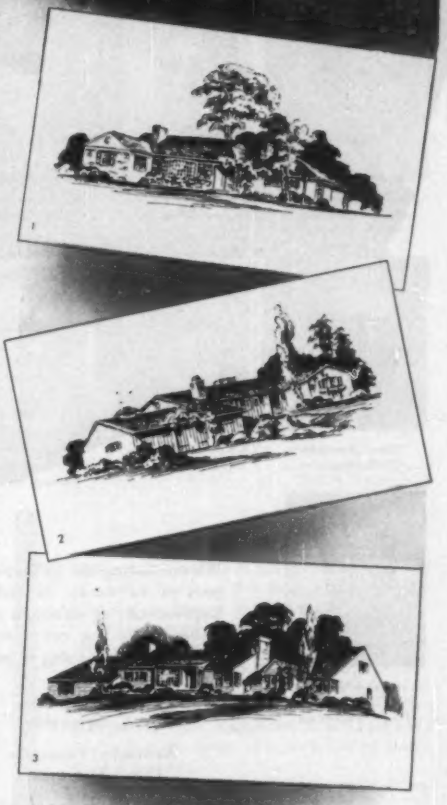
SARCOTHERM CONTROLS, INC.
Empire State Building, New York 1, N. Y.
A SARCO PRODUCT



The heart of the Sarcotherm control system of forced hot water or radiant heating is this unique control valve. It is actuated by liquid expansion thermostats, one located outside the building and one in the valve itself. Between them they vary the proportion of system water re-circulated, to maintain the desired room temperatures.

The Sarcotherm Comfort Control Thermoray is an extremely sensitive thermostat affected by both radiation and convection.

While designed for radiant heating, it is equally effective controlling circulating pumps, motorized valves, or electrically heated panels.



Three typical residences at Smoke Rise, designed by Carl Kemm Loven, A.I.A., Architect:

1. William Nicholson III
2. Douglas Weller
3. John D. Foley

21

FEDDERS MEN ARE

Ohio, Cleveland
J. C. Murphy

Okla., Oklahoma City
J. E. Hamilton

Larry [illegible]
Kenneth [illegible]

[illegible]rill F. Blan[illegible]

Wisconsin, Milwaukee
F. L. Thuemling Co.
Fred L. Thuemling

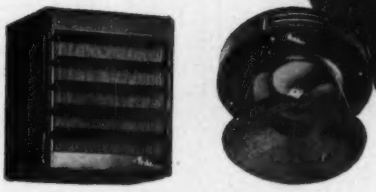
We are listing the following as part of the family of Fedders Representatives although their photographs are not available at the time of going to press:

Illinois, Peoria
A. C. Schwanke

Kentucky, Louisville
David L. Gordon

New York, Syracuse
Syracuse Gen. Sales Co.

Tennessee, Chattanooga
L. D. McIlwain



FEDDERS UNIT HEATERS
Built in horizontal and downblow models

fedders

FEDDERS-QUIGAN

A GREAT NAME IN COMFORT

GOOD MEN TO KNOW

Indiana, Indianapolis
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Iowa, Des Moines
Tom Rae

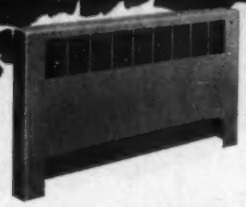
N. Carolina, Greensboro
P. L. Guest Sales Co.
P. L. Guest, Jr.

Ohio, Cincinnati
Kenneth B. Little Co.
Kenneth B. Little

Texas, Houston
Odin Nation
B. E. Drane

Utah, Salt Lake City
Henry S. Parks

Washington, Seattle
Larry Harrington Co.
Neil W. Wilson

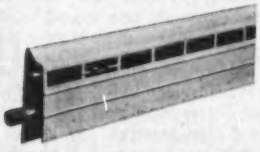


FEDDERS CONVECTOR-RADIATORS

Made in a complete line of sizes for free-standing and recessed installations

FEDDERS WALL RADIATION

For industrial, commercial and institutional buildings



FEDDERS BASEBOARD RADIATION

With exclusive anti-streak covers

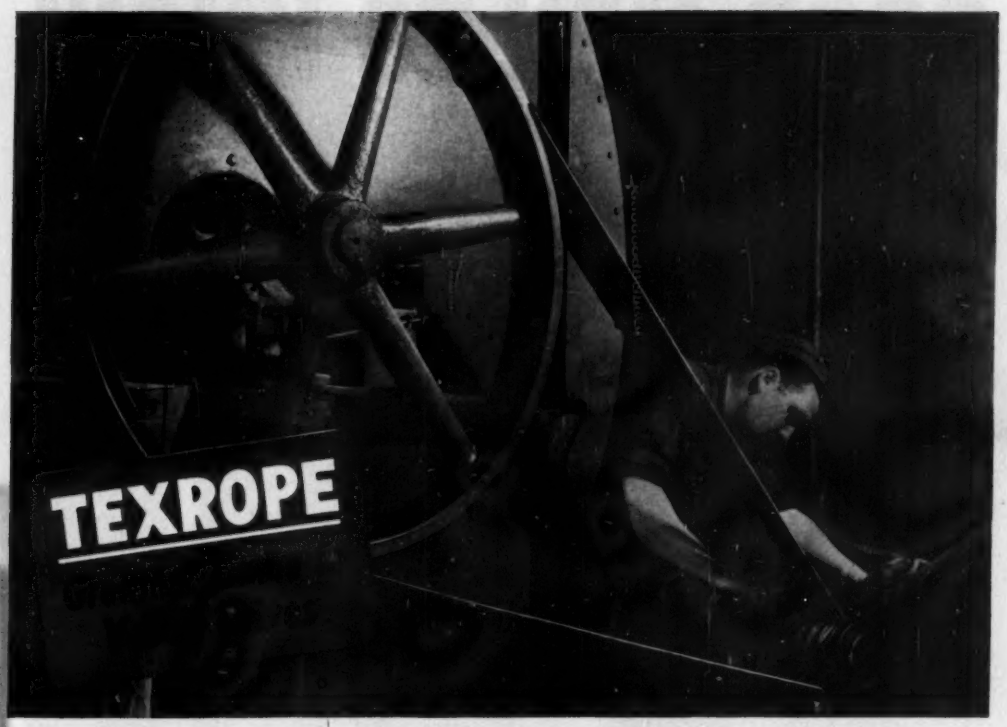
There is a Fedders Representative as near as your telephone. He knows the Fedders line and he knows the Heating business.

This nationwide organization of Fedders Representatives is always at your service... all ways. Your local Fedders Representative is up-to-date on the complete line of Fedders Baseboard Radiation, Convector-Radiators, Wall Radiation, Unit Heaters, and other products. It is their job to make your job easier.

Remember... your Fedders man is as near as your telephone!

If you are not already acquainted with your local Fedders representative, you will find his name in your classified telephone directory. Phone him for latest Fedders Catalogs and first-hand information on Fedders Products.

CORPORATION **BUFFALO 7, N.Y.**



Get Fast System Balancing by Easy Fan Speed Adjustment

YOU SAVE TIME AND MONEY when balancing or adjusting cooling systems if you can change fan speeds quickly. That's why you should equip every installation with *Vari-Pitch* sheaves.

It takes only a few seconds to change the speed of a fan equipped with a *Vari-Pitch* sheave. You get an infinite number of speeds within the range of each sheave. And once the speed has been set, it will not vary.

Texrope drives are completely noiseless and tend to dampen vibration of other parts. Also, multiple V-belts offer a greater safety factor, assuring service continuity.

Expert Engineering Help

One phone call brings you all your drive needs — motor, base, starter, sheaves, and belts — plus expert application engineering and practical help. Get one-day, one-call service for all your drive needs by calling your nearest Allis-Chalmers Authorized Dealer or Sales Office.

SEND FOR BULLETIN

More information on the complete line of *Vari-Pitch* drives is available in Bulletin 20P50. Ask an A-C representative for a copy, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-3379

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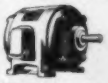
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.



MOTORS — ½ to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

ALLIS-CHALMERS

HENRY LINE VALVES really give you something extra

They give more dependable service because of advanced field-proven design and construction as well as patented features.

PACKLESS VALVES
FOR FREON
with Exclusive Balanced-Action

STANDARD TYPE

Ball check in balancing channel permits diaphragm inspection and replacement with valves under line pressure. Sizes, ¼" thru ⅝" flare; ¼" thru 1⅜" O.D. Solder, ¼" thru 1" F.P.T.

BLUE BANTAM TYPE

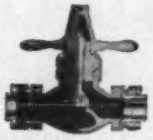
Same as standard Balanced-Action valve except that diaphragms cannot be inspected or replaced under line pressure. Size ¼" thru ⅜" flare and O.D. Solder.

PACKED VALVES
FOR FREON
Bronze-Wing Cap Type

Globe and angle types with solder connections, bolted bonnets, sizes ⅞" thru 5⅛" O.D.

SEMI-STEEL WING CAP TYPE

With bolted bonnets and square companion flanges. Furnished with brass tailpieces (O.D. Solder) 1⅜" thru 5⅛" or with steel tailpieces for welding to pipe, sizes 1¼" thru 5".



Also Globe and angle types with F.P.T. connections, sizes ½" thru 2".

PACKED VALVES
FOR AMMONIA
Permanent-Mold Iron and Semi-Steel

Compact and strong with self-aligning stem disc. Sizes (F.P.T.), screw bonnet: ¼" thru 1", bolted bonnet 1¼" thru 2"—with flange connections 1¼" thru 5".

HENRY—Standard equipment by leading Manufacturers, Army, Navy, Coast Guard and Maritime Commission • Stocked by Leading Jobbers

WRITE FOR CATALOGS

HENRY VALVE CO.

HENRY VALVE CO. CONTROLLING FLOW

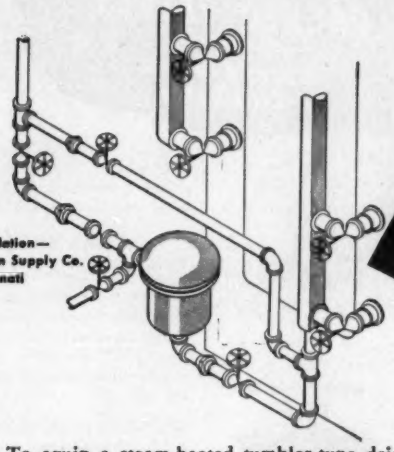
Valves—Driers—Strainers—Control Devices and Accessories for Refrigeration, Air Conditioning and Industrial Applications

MELROSE PARK, ILL. (CHICAGO SUBURB)
CABLE: HEVALCO, MELROSE PARK, ILLINOIS

for outstanding service

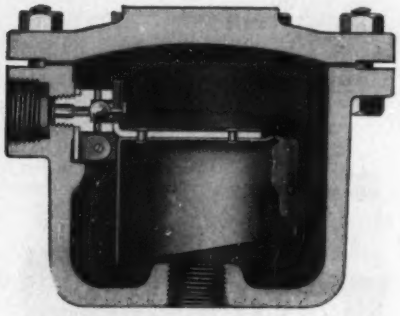
on Heavy-Duty Steam Drying Units

...for example



The installation—
American Linen Supply Co.
Cincinnati

Rely on Dependable CRANE STEAM TRAPS



Crane Inverted Open Float Steam Trap with patented ball-type disc, for 1 to 300 pounds saturated steam working pressures. Literature on request from your Crane Branch or Crane Wholesaler.

PROBLEM: To equip a steam-heated tumbler-type drier with a trap that would reduce start-up time to a minimum, and provide, automatically, a smooth, steady flow of hot, dry steam to the unit, with the lowest possible maintenance cost.

WORKING CONDITIONS: Steam pressure to drier, 125 pounds. Drier operated 16 hours daily on continuous batch basis.

SOLUTION TO PROBLEM: Crane No. 981, ¾-inch, 150-Pound Inverted Open Float Trap, carefully selected for adequate drainage capacity, and properly installed. (Now listed as No. 9810, with patented improved ball-type disc.)

RESULTS: Never requiring any repairs or new parts in more than 8 years' service, this Crane trap has given complete satisfaction. Periodic routine inspection only is total maintenance cost.

... ANOTHER TYPICAL CASE HISTORY demonstrating the better performance... the lower ultimate cost of Crane Valves of all types ... and why—

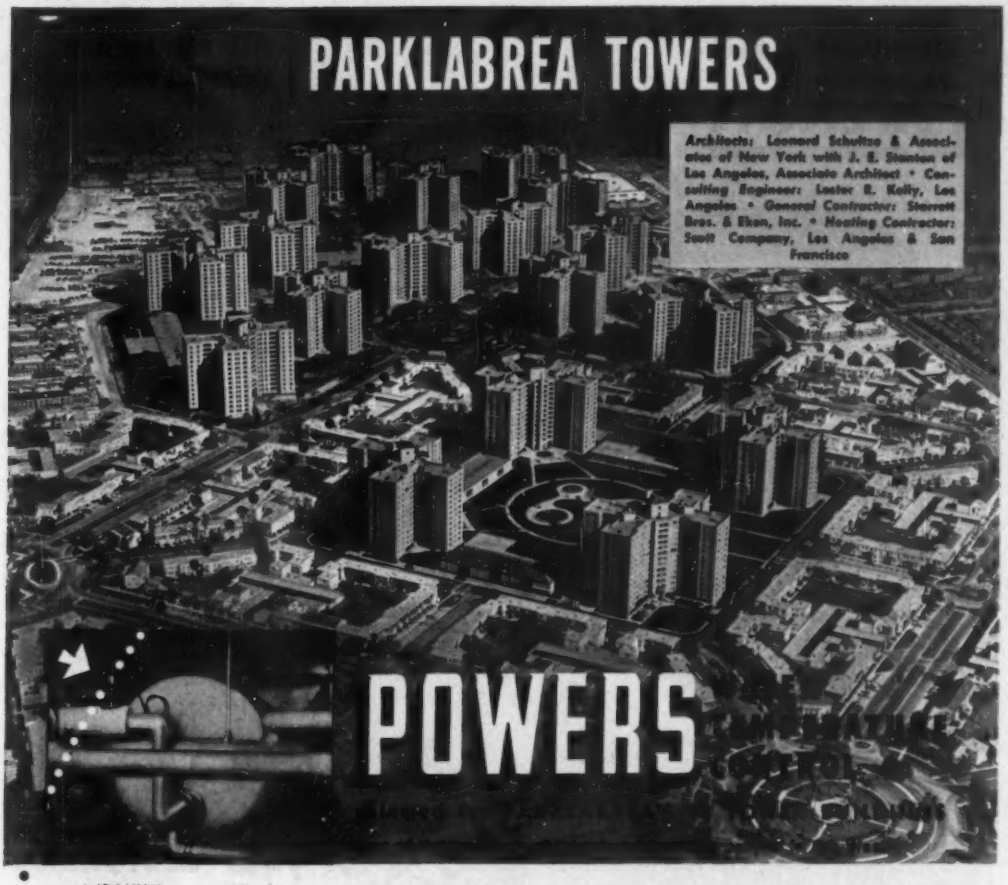
More Crane Valves are used than any other make!

CRANE CO.

General Offices:
836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

PARKLABREA TOWERS

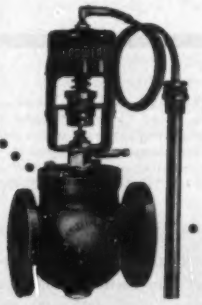


Architects: Leonard Schultze & Associates of New York with J. E. Stanton of Los Angeles, Associate Architect • *Consulting Engineer:* Lester B. Kelly, Los Angeles • *General Contractor:* Stevrett Bros. & Ekon, Inc. • *Heating Contractor:* Swift Company, Los Angeles & San Francisco

Provides Best Insurance obtainable for dependable regulation of domestic hot water storage heaters. Each of the 13 story buildings contains 2 Powers 3″ No. 11 Regulators. They stop hot water complaints by preventing over-heated water. Fuel economies alone often pay back their cost 3 to 6 times a year. Many users report 15 to 25 Years of Reliable Control.

For help in selecting the right type and size regulator for your requirements contact your nearest Powers office. There's no obligation.

THE POWERS REGULATOR COMPANY



POWERS CONTROL 60th

36 POWERS No. 11 Temperature Regulators used in the 18 tower buildings shown above.

Only one of many types of POWERS Control.

SKOKIE, ILL. • OFFICES IN OVER 50 CITIES

Chicago 13, Ill., 3819 N. Ashland Ave. • New York 17, N. Y., 231 E. 46th St. • Los Angeles 5, Cal., 1808 West 8th St. Toronto, Ont., 195 Spadina Ave. • Mexico, D. F., Apartado 63 Bis.

(ad5)

demand DETROIT CERTIFIED CONTROLS

This Exclusive Combination of DETROIT Features

V-579 "BI-FLEX" GAS VALVE

★ Quiet operation—no click, no hum. An ideal replacement for noisy valves.
★ Rugged, compact design—easy to service.
★ Inexpensive.
★ Adaptable to all gases.
★ "Bi-flex" motor operated—low voltage.
★ Temperature and voltage compensation.
★ Snap-action opening and positive closing.
★ ½ inch to 1¼ inch sizes.

The exclusive features of the V-579 "Bi-flex" Gas Valve prove that you get more for your money when you deal with DETROIT. You can always count on giving your customers a better job when you install any DETROIT control. DETROIT controls are designed and built to fill your customers' needs—to give real economy and reliability through years of trouble-free service. The V-579, for example, at low initial cost, gives your customers an exclusive combination of outstanding features which provide new standards for the efficient and quiet operation of modern gas burning equipment. And that's exactly the kind of operation that pays off with more comfort for the user, more sales and profits for you. So take advantage of this extra value—insist that your source of supply furnish DETROIT controls with all your heating equipment. Write for Bulletin No. 229.

Means More Comfort for your Customers

More Profits for You!

No. 411 Thermostat—A sensitive and accurate *Timed Cycling* thermostat for all types of heating systems. Provides close control of room temperature. Attractively styled, easily installed and adjusted. Write for Bulletin No. 193 and Form No. 1545.

DETROIT LUBRICATOR COMPANY

5900 TRUMBULL AVE., DETROIT 8, MICHIGAN
Division of American Radiator & Standard Sanitary corporation
RAILWAY & ENGINEERING SPECIALTIES, LTD.
Canadian Representatives in Montreal, Toronto, Winnipeg.

"DETROIT"

DETROIT HEATING AND REFRIGERATION CONTROLS • ENGINE SAFETY CONTROLS • FLOAT VALVES AND OIL BURNER EQUIPMENT • DETROIT EXPANSION VALVES AND REFRIGERATION ACCESSORIES • STATIONARY AND LOCOMOTIVE LUBRICATORS

Trusted home and industry AMERICAN STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS GEARS • TONAWANDA IRON

in CARBON, ALLOY and STAINLESS STEELS

. . . Still your best buy, because W-S longer service life and increased dependability give that permanency which will lower maintenance costs . . . They are drop forged.

Basic materials are selected from a wide choice of carbon, stainless and alloy steels and then subjected to the most exacting metallurgical controls from melt to bar. Through these precautions and subsequent precision machining operations, W-S assures the utmost in accuracy of finish, perfection of threads, sockets, angles and concentricity. All W-S Fittings, — Screwed and Socket Welding Types, — are finally instrument inspected.

W-S Bulletin A3-50 details the Carbon Steel Line. Bulletin S-1 is devoted to Stainless and the Alloys. W-S will gladly furnish information on the new FEATHERLITE Fittings — a recent big step in a wide range of services. Write today for the specific bulletin you desire.

Sold Through Leading Distributors

9-L-2

DISTRIBUTOR PRODUCTS DIVISION

WATSON-STILLMAN

Established 1848

ROSELLE, NEW JERSEY

Designers and Manufacturers of Forged Steel Fittings, Valves, Wire Rope Sheaves, Hand Presses, Jacks, Pipe Benders and Hydraulic Equipment

Three different temperatures

FROM THE SAME BOILER

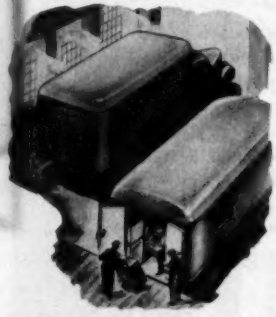
B&G *Hydro-Flo** Heating

B & G *Hydro-Flo* Heating keeps offices at the proper temperature for sedentary occupations—prevents over and under heating.

72°

Worker efficiency is stepped up by B & G *Hydro-Flo* Heating. Each department can be maintained at the temperature best suited to occupational activity.

68°



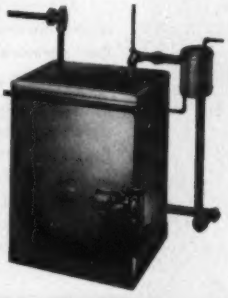
Garages and storerooms need little heat. B & G *Hydro-Flo* Heating saves fuel by keeping such areas at a comparatively low temperature.

50°

Dividing a B & G *Hydro-Flo* System into a number of heating zones permits different temperatures to be maintained in different sections of a building. The advantages are two-fold . . . greater comfort for workers at every level of physical activity and a substantial reduction in heating cost.

B & G *Hydro-Flo* Heating—a forced hot water system—eliminates the usual causes of uneven, wasteful heating. Water as a heating medium can be so closely controlled that every change in the weather is met with a corresponding change in the heat supply. Hence, indoor temperature is maintained uniformly at whatever degree is desired.

Any type of radiant heating units can be used with B & G *Hydro-Flo* Heating—baseboard panels, convectors, radiators, radiant floor and ceiling panels or unit heaters. No complex controls are required —*Hydro-Flo* equipment is amazingly simple and dependable.



For residential application

Hundreds of thousands of homes and apartments today have B & G *Hydro-Flo* Heating. This system provides radiant sunny warmth with all the economy of a controlled heat supply . . . and in addition furnishes an abundance of domestic hot water all year 'round.

Send for catalog of B & G *Hydro-Flo* Heating Products

*Reg. U. S. Pat. Off.

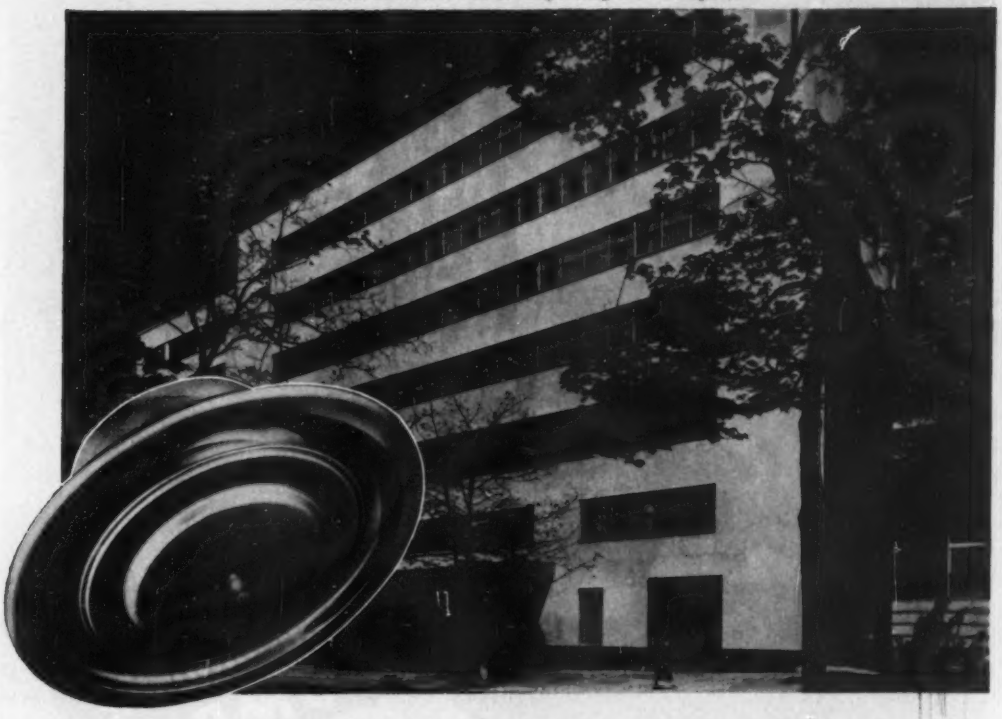
BELL & GOSSETT

COMPANY

Dept. CH-5, Morton Grove, Ill.

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto, Canada

Architects and Engineers: Albert Kahn Associated Architects and Engineers, Inc., Detroit, Michigan
Mechanical Contractor: Standard Engineering Co., Washington, D. C.



FOR APPEARANCE . . . FOR EFFICIENCY

kno·draft adjustable air diffusers

From first-floor pressroom to seventh-floor offices, The Washington Post's new building is completely air conditioned. Distribution is through Kno-Draft *Adjustable* Air Diffusers—smart in appearance, unobtrusive and, above all, *efficient.*

There are *no drafts* with Kno-Draft *Adjustable* Air Diffusers. Air distribution is gentle, maintaining an even temperature throughout the conditioned space. Air flow pattern and volume can be adjusted *after* installation—an important factor in operating efficiency and in reducing preliminary engineering.

Kno-Draft *Adiustable* Air Diffusers can be used in their natural spun aluminum finish, or painted to blend with ceilings. They are "at home" in either modern or traditional surroundings.

Let Connor Engineering Service work with you on your next air conditioning "specs." There are types and sizes of Kno-Draft *Adjustable* Air Diffusers for every requirement.

KNO-DRAFT DATA BOOK: Complete specifications, engineering and installation data on Kno-Draft *Adjustable* Air Diffusers. To get your copy, simply fill in and mail the coupon. No obligation, of course.

TRADE MARK "KNO-DRAFT" REG. U. S. PAT. OFF.

W. B. CONNOR ENGINEERING CORP.
Danbury, Connecticut
Air Diffusion · Air Purification · Air Recovery
In Canada: Douglas Engineering Co., Ltd.,
190 Murray Street, Montreal 3, P. Q.

W. B. CONNOR ENGINEERING CORP.
Dept. G-121, Danbury, Connecticut

Please send me, without obligation, my copy of the Kno-Draft Air Diffuser Data Book.

Name.....
Position.....
Company.....
Street.....
City.....**Zone**.....**State**.....

1. Superior Construction

Close-coupled construction with pump and motor on a single shaft assures accurate alignment and maximum rigidity to maintain that alignment. Bearing and seal life are prolonged. All units are equipped with high-grade mechanical seal which requires no maintenance and no adjustment when the pump is installed. Motors are of a well-known standard make which have passed thorough Allis-Chalmers tests for reliability. Ball bearings are of the sealed type, which means they will run for years without attention.

2. Easy Mounting in Any Position

The simple two-screw mounting bracket makes it easy to mount this pump in any position or location as long as the motor end of the shaft is horizontal or above. You save time, trouble and installation cost. The same basic pump design is also available in a vertical model specially designed for sidewall mounting in tanks and basins without special provisions. The discharge flange is simply bolted to the side of the tank.

3. Ample Engineering Assistance

A competent Allis-Chalmers pump application engineer with wide experience in applying air conditioning pumps will be glad to help you select exactly the pump you need for dependability at lowest cost. These qualified engineers can often suggest cost-saving changes in your installation. And they have a complete range of types and sizes to choose from. Next time you need help on your pumping problems, call the Allis-Chalmers Authorized Distributor or District Office near you. Or write Allis-Chalmers, Milwaukee 1, Wisconsin and ask for Bulletin 52B 7529. A-3520

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

MOTORS — ½ to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.

Texrope and Vari-Pitch are Allis-Chalmers trademarks.

ALLIS-CHALMERS

When winter goes south... Spang 'CW' pipe brings summer inside this school—

Even in sunny Macon, Georgia, winters can be cold and uncomfortable at times. So, when this Junior High School for Girls was designed with full facilities for modern teaching, it was also planned for modern heating —radiant heating, of course.

And, as is so often the case where architects and contractors emphasize durability and reliability, Spang "CW" Pipe was specified for this permanently sealed heating system, as well as for other requirements.

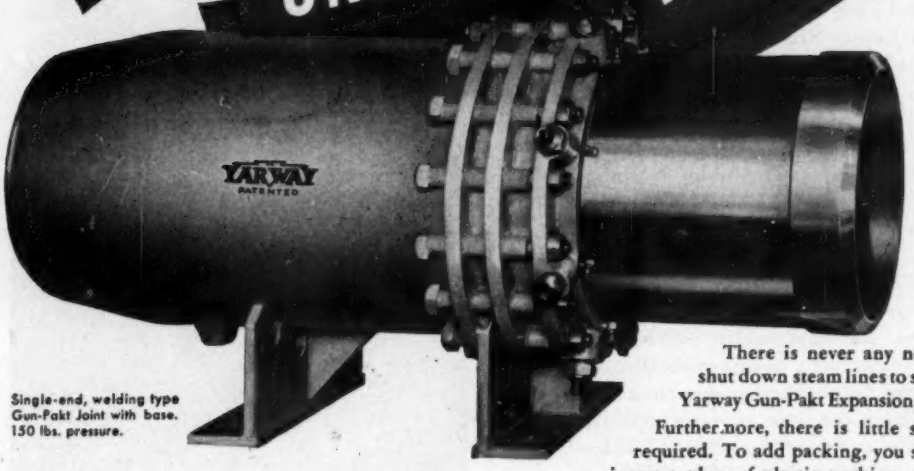
When *you* need a truly dependable pipe for commercial, industrial or residential installations, ask your jobber for Spang "CW"— the pipe that's quality-controlled from steel to you. Easy to bend, easy to cut, easy to thread, it offers you *both* an extra measure of reliability and faster installation features.

Remember... the Spang trademark is a guarantee of greater satisfaction *to you* as well as to your customer.

Architect: MacEwen, Hall & Ferguson, Macon, Georgia; *Engineers:* Bloomfield Engineering Co., Macon, Georgia; *General Contractor:* Amerson & Freeman, Macon, Georgia; *Plumbing & Heating Contractor:* Hancock Plumbing Co., Macon, Georgia

CHALFANT Division of The National Supply Company
GENERAL SALES OFFICES: Grant Building, Pittsburgh 30, Pa.
District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis

THIS EXPANSION JOINT IS SERVICED UNDER FULL STEAM PRESSURE



Single-end, welding type Gun-Pakt Joint with base. 150 lbs. pressure.

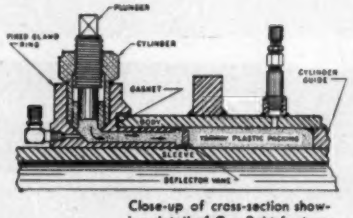
There is never any need to shut down steam lines to service Yarway Gun-Pakt Expansion Joints.

Furthermore, there is little service required. To add packing, you simply insert a plug of plastic packing, turn a wrench, and the job's done! Special Alemite fittings provide for proper lubrication.

Maintenance costs are trifling. One large user reports 65 cents per year per joint. Others claim less than that.

Gun-Pakt Joints are available with single or double-ends, welding or flanged types, in sizes from 2″ to 30″, with traverses from 4″ to 24″, and for pressures to 400 psi.

For the full Gun-Pakt story, write for Yarway Bulletin EJ-1912.

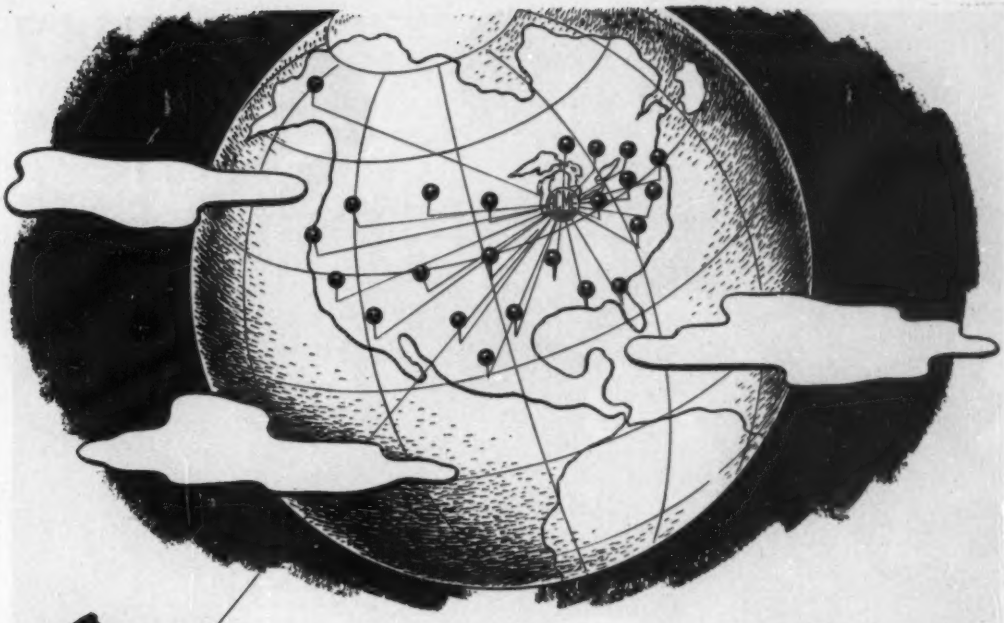


Close-up of cross-section showing detail of Gun-Pakt feature.

YARNALL-WARING COMPANY
107 Mermaid Avenue, Philadelphia 18, Pa.

YARWAY

GUN-PAKT EXPANSION JOINT



Acme products are in use *Everywhere*

In every major industrial center, you will not have far to go—to see a successful and efficient installation of *ACME* Refrigeration or Air Conditioning equipment. In offering practical solutions to temperature control problems, *ACME* Engineers have had an opportunity to study normal and abnormal temperatures, humidity and prevailing conditions. From this long experience *ACME* Engineers have developed a line of refrigeration and air conditioning components that meet practically every requirement of the Refrigeration and Air Conditioning Industry. Whatever your immediate problem may be, the chances are that the nearest *ACME* representative can show you an actual installation of *ACME* products which is successfully meeting requirements similar to yours. *ACME* Products have been tried and are in actual use in practically every climate under practically every possible condition. You can depend on this long established and time tested line of major refrigeration components to give you efficient, low cost, long lasting service.

THE COMPLETE *Acme* LINE INCLUDES

Freon Shell and Coil, Shell and Tube and Ammonia Condensers.
***Dry-Ex Water Coolers**
***Hi-Peak Water Coolers**
Heat Exchangers
Unit Coolers
Oil Separators
Convectors
***Flow Cold Liquid Chillers**
Evaporative Condensers
Cooling Towers
Liquid Receivers
Air Handling Units

* TRADE MARK

Free Consultation with ACME Engineers is yours for the asking.
Write ACME INDUSTRIES, INC., Dept. HP, Jackson, Michigan

ACME INDUSTRIES, INC., JACKSON, MICHIGAN, U.S.A.
Refrigeration and Air Conditioning Division

CONTINUOUSLY SERVING THE AIR CONDITIONING AND REFRIGERATION INDUSTRY SINCE 1919

"We have to know that this new mine is going to do its job even after riding for hours under the belly of a plane or being stored long periods in sub-zero temperatures," said R. E. Hightower, chief of the Technical Evaluation Department, Naval Ordnance Laboratory, White Oak, Maryland. The desired temperature and humidity conditions are precisely provided by Worthington refrigeration. Contractor, Arthur E. Magher Co., N.Y., N.Y.

They're Checking Ordnance at 65° Below!

You see, that cylindrical object is a mine. The masks keep faces from freezing as the Navy studies icing effects to be certain that neither ice nor stiffened parts will affect its operation when dropped from a sub-zero atmosphere into the ocean.

These studies are made in the new stainless steel temperature simulation chamber at the Naval Ordnance Laboratory, White Oak, Maryland, where ordnance equipment can be subjected to temperatures from 200 above to 100 below zero, Fahrenheit, with any desired humidity.

The naval laboratory uses a Worthington brine cooling system composed of one centrifugal compressor and four reciprocating compressors to reduce the temperature of the chamber to minus 100 F.

This is but one of many military low-temperature installations where Worthington products are helping to insure that our armed forces get the best equipment in the world.

The knowledge and experience which has made Worthington a leader in this field is available to you for any type of air conditioning or refrigeration installation. Consult Classified Telephone Directory for nearest Worthington distributor. Worthington Pump and Machinery Corporation, Air Conditioning and Refrigeration Division, Harrison, N. J., specialists in air conditioning and refrigeration for more than 50 years.

A1.4

WORTHINGTON

AIR CONDITIONING AND REFRIGERATION

THE MOST COMPLETE LINE... ALWAYS THE CORRECT RECOMMENDATION

This machine practically thinks for itself!

It's uncanny the way this DeVlieg JIGMIL handles the most complex boring and milling operations *automatically*, simply by pushing a button on the control panel.

For example — by simple push button control, the workpiece is positioned both horizontally and vertically, and holes are automatically spaced and bored to exact tolerances. A unique index table allows machining of parts from four sides without rechucking. A power tool lock permits locking or releasing cutting tools in a few seconds.

Howell engineers worked closely with this manufacturer to make sure each of the five Howell motors fitted its job exactly. The three 2-speed and two single-speed Howell motors make a vital contribution to the remarkable efficiency of this machine.

Howell will supply the same high degree of engineering skill and experience to your problems. You are assured of quality motors designed for your specific requirements, built to stand up under the heaviest production loads. May we handle your electric motor needs?

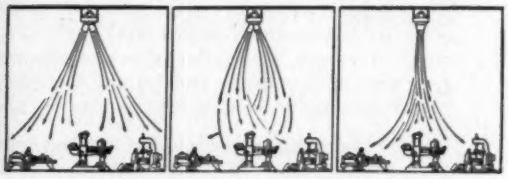
HOWELL Red Band MOTORS

HOWELL ELECTRIC MOTORS CO., HOWELL, MICH.

Precision-built industrial motors since 1915

He said it was the first time in 15 years his feet had been warm!

IT happened in a large manufacturing plant in Pittsburgh where, originally, several conventional type unit heaters had been installed to heat a machine shop 300' long by 70' wide by 15' high. After many uncomfortable winters and many complaints additional units were installed. But complaints by workers continued, and finally led to an investigation of Wing Revolving Unit Heaters. First, the Wing engineer showed conclusively by smoke bomb demonstration that the warm air from the heaters in the plant did not reach the working level. Convinced of the soundness of the revolving discharge principle, the old heaters were removed and Wing Revolving Unit Heaters installed. A smoke bomb test showed how the warm air not only reached the floor, but gave complete coverage, circulating in, around and under heavy machinery and work in progress. The effect was remarkable. In fact, one old mechanic said it was the first time in 15 years his feet and legs had been warm!



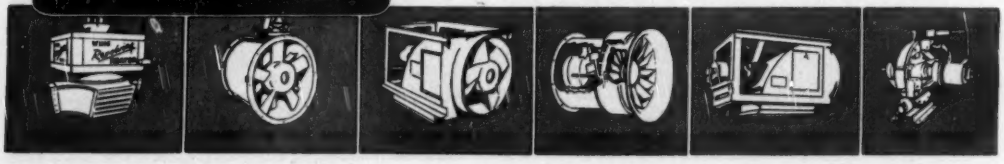
Wing

REVOLVING UNIT HEATERS

Illustrated above are (left) a plant similar in type to the one mentioned in the story, showing Wing Revolving Heaters with discharge outlets for high ceilings. Other discharge outlets are available for medium heights and low buildings and rooms. The diagram (above right) shows how the constantly turning discharge outlets thoroughly and uniformly distribute the heated air, without hot blasts or cold drafts. Workmen feel only a sensation of fresh, live, invigorating warmth. Write for a copy of Bulletin HR-6.

L. J. Wing Mfg. Co. 140 Vreeland Mills Rd., Linden, N.J.

Factories: Linden, N. J. and Montreal, Canada
In Europe: Etablissements WANSON, Haren-Nord, Brussels, Belgium



Looking for a source for Dependable Copper Tube

— — — PLAIN or FABRICATED?

If copper tube is a component of the product you have been asked to make for the defense effort, look to Wolverine to supply it—either plain or fabricated. As a prime contractor, you may welcome this suggestion, especially if in your regular production you use other materials and different operations.

Here are some of the many reasons why you should choose Wolverine as the source for top quality tube:

1. You have at your command the specialized skill and experience of over 34 years of exclusive tube manufacture.
2. At Wolverine you'll find the most modern and efficient facilities to produce the tubular part that will meet your specifications.
3. Your problem will be accepted with a thorough understanding and regarded in utmost confidence. We are accustomed to working with government agencies.
4. Available to you are many specialized processes, like end spinning and finning—both of which were developed by Wolverine.
5. Careful consideration will be given special packaging, palletizing, crating, etc., to assure the receipt of your required tubing or tubular parts in satisfactory condition.

•

Call on the nearest Wolverine sales office (there's one in every principal city) for any assistance you need. Or consult our Customer Engineering Service located in Detroit.

WOLVERINE TUBE DIVISION

Calumet & Hecla Consolidated Copper Company

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Low Cost—Priced to Sell and Sell Fast!

THESE TERRIFIC ADVANTAGES MAKE *UTILITY'S* 50 RD EASIEST TO SELL:

1. Highly competitive price.

2. Circulates air at living level, eliminates cold floors and stagnant hot air at ceiling...because warm air is discharged where it's wanted.

3. Exterior is safe and cool to the touch because outer panel is Fiberglas-insulated with aluminum foil backing.

4. Available in models for natural, manufactured and liquefied petroleum gases.

5. Available with fully automatic thermostatic controls, plus 3-manual control for 100%, 50% and 30% of full rating of unit.

6. The Utility 50 RD Recessed Dual Wall Heater fits between standard 16" center studs.

7. 50,000 BTU Input, 35,000 BTU Output. Dimensions: Height, 60"; Outside Panel Width, 17".

8. A.G.A. approved *under new 1952 Requirements.*

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TAPER-LOCK bushing grips the shaft for the full length of the bushing — holds sheave with firmness of a shrunk-on fit. No wobble. Taper-Lock runs true!

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The grooves, machined on precision equipment, have identical pitch diameters. This insures equal belt tension. Every belt pulls its share of the load!

TAPER-LOCK sheaves are available from distributors' stocks in complete range of sizes in A, B, C and D grooves.

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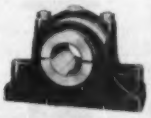

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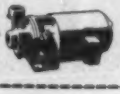

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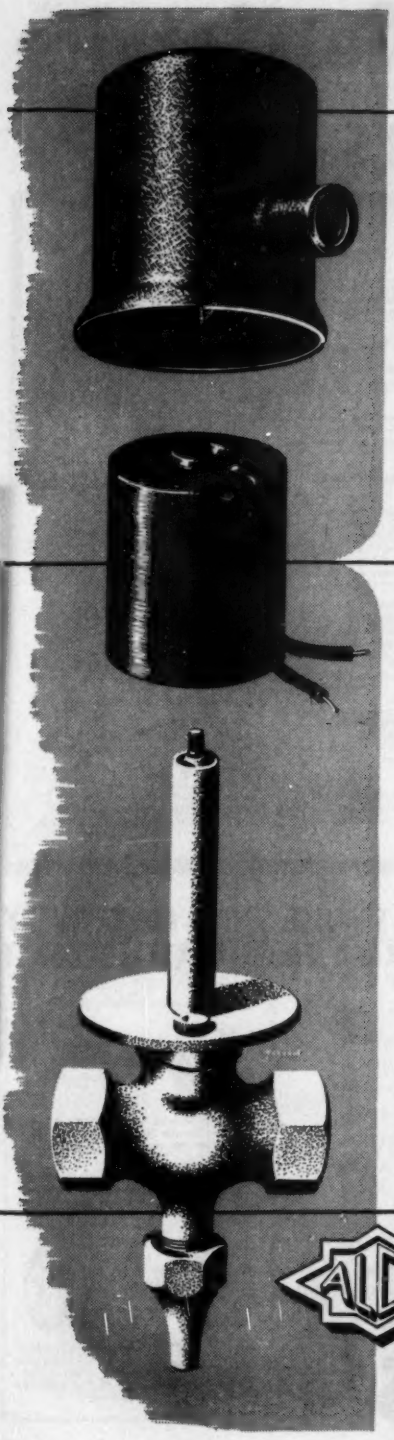

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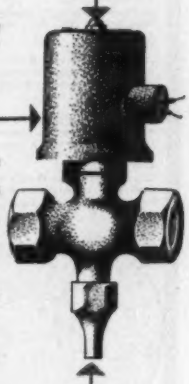

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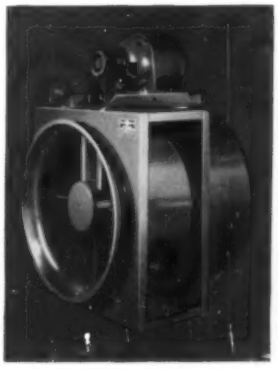
Product of the month

American Blower
Series 201 Axial Fans



They pay off in performance

American Blower vaneaxial fans are smooth in performance, built for endurance, and convenient to install. Guide vanes serve to transform waste energy into useful work and thereby make possible a substantial improvement in efficiency.

Tubeaxial fans have axial flow fan wheels and casing cylinders similar to the vaneaxial type but are furnished without directional guide vanes. The Series 201 tubeaxial fan is more than just a propeller fan in a cylinder. It is a rugged, smooth-operating, axial-type fan specially designed for moderate pressure duties.

Air is free. Why not let American Blower Fans help you use it profitably? For additional data, contact your nearest American Blower Branch Office.

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MORE SCRAP TODAY...
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THE iron and steel industry faces a serious scrap shortage, growing more critical every day. . . . It will be impossible for producers to make the steel tonnages demanded for rearmament and essential civilian needs, unless consumers cooperate by furnishing *more scrap*. . . . Most desperately needed now is heavy industrial iron and steel scrap. . . . Keep the cobwebs from gathering at your own plant by turning in more of your own scrap today.

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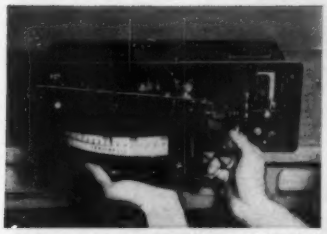
The steel industry is using all its resources to produce more steel, but it needs your help and needs it now. Turn in your scrap, through your regular sources, at the earliest possible moment.



G-E Pyrometer Equipment Quick and Easy to Inspect, Maintain

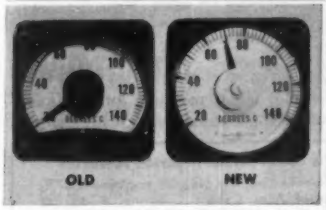
Routine inspections of new General Electric Type HP pyrometers can quickly be made. Besides making preventative maintenance easy, this equipment has many other features to provide accurate indication and temperature control of furnaces, ovens kilns, and other industrial heating equipment.

ACCURATE WITHIN ¾ OF 1% full scale, HP-3 pyrometers have automatic cold-junction compensation that adjusts for changes in ambient temperature.

Any change in temperature, even as small as 0.1% full scale, starts immediate control action. Normal changes in humidity, ambient, and voltage have little or no effect on the exactness of control action.

FOUR TYPES AVAILABLE—indicating, protecting, two- and three-position control forms; also both flush and surface mountings. All available in a variety of temperature ranges in the 0-3000 F span.

Mail the coupon for complete information about Type HP pyrometers.



New Shadow-proof Temperature Indicators Are Easier to Read

Temperatures from −100 F to +300 F can now be accurately indicated and controlled with General Electric's new line of temperature indicators. These instruments can be read from almost any angle. The dial is set forward, flush with the front of the case. A protruding convex-type glass front provides clear illumination. No more cover overhang; no more shadows caused by overhead lighting. Two sizes available—4¼- and 8¾-inches. Check coupon.

New Resistance Thermometers Accurately Indicate and Control Low Temperatures

TEMPERATURES FROM −100F to +300 F can now be accurately indicated and controlled with General Electric's new line of resistance thermometers. They indicate accurately within ¾ of 1 per cent full scale. Any change in temperature equivalent to 1/10 of 1 per cent full scale starts immediate control action.

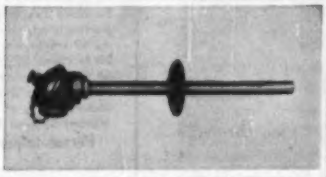
Normal changes in humidity or room temperature do not affect the exactness of control. Neither does a change in control voltage. Sturdy, simple construction assures reliable operation under severe operating conditions.

NARROW TEMPERATURE SPANS, as small as 90 degrees, are available anywhere in the −100 F to +300 F range. You can buy four types of resistance thermometers—indicators, protectors, and two- or three-position controllers—for either flush or surface mounting.

For complete information, mail the coupon below.

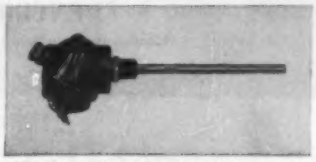
THERMOCOUPLE POTENTIOMETER measures temperature in locations inaccessible to glass-stem thermometers. Any number of different readings can be taken in rapid succession and accurate within ±0.2% of full scale.

Typical applications include refrigerator-development work, oil-burner and air-conditioning tests, steam temperature measurements, and heat-run tests on electric equipment. For complete information, mail the coupon below.



THERMOCOUPLES, COMPONENTS, AND ACCESSORIES for your pyrometer installations include protecting tubes and wells, thermocouple wire, ceramic insulators, extension wire, connectors, heads, selector switches. Send coupon today for catalog to help you obtain proper thermocouple assemblies.

Resistance Bulbs Accurate Within ±1 F between −100 F and +300 F



FOR ANY RESISTANCE THERMOMETER INSTALLATION, new G-E resistance bulbs offer a high degree of accuracy and reliability. They're available either with completely enclosed terminal head or without terminal head and with four feet of flexible cable. Units will retain calibration within 0.1 F. For complete information, mail the coupon below.

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- ☐ Resistance Thermometer (GEC-835)
- ☐ Resistance Bulb (GEC-835)
- ☐ Type HP-3 Pyrometer (GEC-713)
- ☐ Temperature Indicators (GEC-2188)
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Chairman of the Board, Burlington Mills

"The Payroll Savings Plan is one of the important personnel services offered to the employees of our company. At the present time some 15,000 employees in all branches of our organization are taking advantage of this splendid plan for systematic savings. In times of national emergency this plan assists in stabilizing the economic life of the employee, the community and the nation."

Last call for the 1951 Defense Bond Campaign!

While the campaign was scheduled for six weeks, beginning Labor Day, the *accounting period* will include all Payroll Savings Plan bond purchases and enrollments in September *and October*.

If *you* haven't conducted a person-to-person canvass to put a Payroll Savings Blank in the hands of every man and woman in *your* company there is still time to join the thousands of companies which have added nearly a million employees to the Payroll Savings Plan through person-to-person canvasses.

Phone, wire or write to Savings Bond Division, U. S. Treasury Department, Suite 700, Washington Building, Washington, D. C. Your State Director will give you all the help you need—application blanks, posters, envelope stuffers, personal assistance.

Give your employees an opportunity to save for their future and at the same time, help to maintain America's economic security—put an application blank in their hands.

Results of a few recent person-to-person canvasses

Firestone Tire and Rubber Company (40,000 employees), 87% participation; Universal Atlas Cement Company, 67.8% of 4,789 employees . . . Martha Mills, 71% of 2,200 employees . . . Lit Brothers, 52% of 3,600 employees . . . Delta Air Lines, 65% of 2,100 employees; Aerojet Engineering Corporation, 78.1% of 2,000 employees . . . Brown-Lipe Chapin Division of General Motors, 87% of 1,750 employees; Fabricast Division, General Motors, 85% of 1,700 employees.

Person-to-person canvasses now under way include:

	Number of Employees
38 Major Railroads	993,142
Radio Corporation of America	40,000
Owens-Illinois Glass Company	25,000
Cudahy Packing Company	17,000
Pacific Gas and Electric	17,000
Willys-Overland	6,750
Owens-Corning Fiberglas Corp.	6,500
White Motor Company	6,500
Fruehauf Trailer Company	5,700

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The fans with the complete size selection — 600 cfm to over half a million cfm — to match almost any ventilating or air conditioning requirement, they are non-overloading regardless of system pressure. Double backward curved blades, specially shaped housing scroll and inlet guide vanes make for unusually quiet, efficient delivery. WRITE FOR BULLETIN 3737.

AXIAL FLOW

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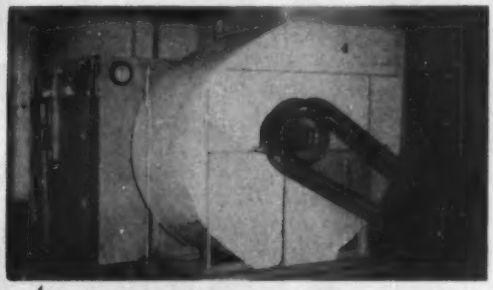

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PC CABINETS

These space-saving central air conditioning cabinets are quality-built in all parts to do a thorough, satisfactory job. Easy on installation and maintenance, they are available in vertical (VPC) or horizontal models, for any desired air conditioning functions — humidity control, air cleaning, heating, cooling. For all data on the model for your job, request BULLETIN 3703.

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Used throughout industry for the past fifty years, "Buffalo" Air Washers are efficient, reliable units doing a hundred and one comfort, quality control and health jobs removing dust, dirt and bacteria from the air as well as cooling and humidifying. A wide range of types and capacities—described in BULLETIN 3181-B. Write for your copy!

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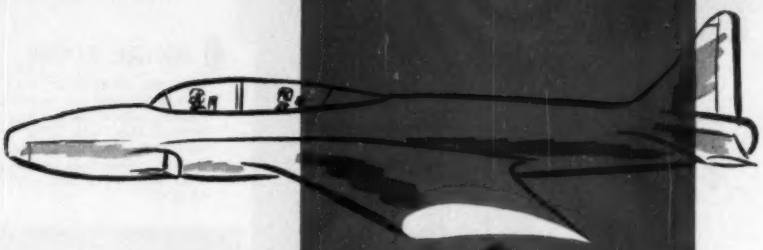
VENTILATING FORCED DRAFT AIR WASHING COOLING AIR TEMPERING HEATING INDUCED DRAFT EXHAUSTING PRESSURE BLOWING

AND NOW



New Airfoil Fan wheel with the side plate removed.

Conventional Fan Wheel— This shows the flat, backwardly-inclined blades now used in a conventional non-overloading centrifugal fan.

Airfoil Fan Wheel— This shows how the Airfoil blades in the new non-overloading wheel differ from the design at the left.

A CENTRIFUGAL FAN WITH AIRFOIL BLADING

Sturtevant Pioneers Again

Here's another major advance in fan design by Sturtevant —the new Airfoil Non-Overloading Centrifugal Fan.

In 1914, Sturtevant made high efficiency possible with the non-overloading centrifugal fan—the TURBOVANE®. Then, in 1930, low-cost Sturtevant VANE CONTROL® increased the efficiency of part-load operation. Now, in 1951, the new Sturtevant Airfoil blade achieves new heights in peak efficiency with "the wings of an airplane" housed in a centrifugal fan.

Higher Efficiency and Quieter Operation

Sturtevant's scientific application of Airfoil Blading produces a new high in efficiency and a new low in noise level:

Efficiency . . .	**90% plus**
Noise Level . .	**65% less**

Wherever operating cost means more than first cost—where evaluation and a reasonable price mean more than a low price—the Sturtevant Airfoil, Non-Overloading Fan is the answer.

Recent Purchasers

Airfoil Fans were selected by the Consolidated Edison Company of New York for their Astoria and East River Plants, and have been *successfully witness tested.* Other orders have been received from Duke Power Co., New York Gas & Electric Co., Pennsylvania Electric Co., Tennessee Valley Authority, and also for ventilation of the new Squirrel Hill Tunnel in Pittsburgh.

Where To Use

If low operating cost is of primary importance to you in your air handling applications, as it is in mechanical draft for utility and industrial power plants, in high-velocity air conditioning systems, and for vehicular tunnel ventilation, this new fan is available to you. For full information, contact your local Westinghouse-Sturtevant office, or write to Westinghouse Electric Corporation, Sturtevant Division, 169 Damon St., Hyde Park, Boston 36, Massachusetts.

For heavy-duty and mechanical draft applications, the Airfoil wheel is used in the proved, [illegible]

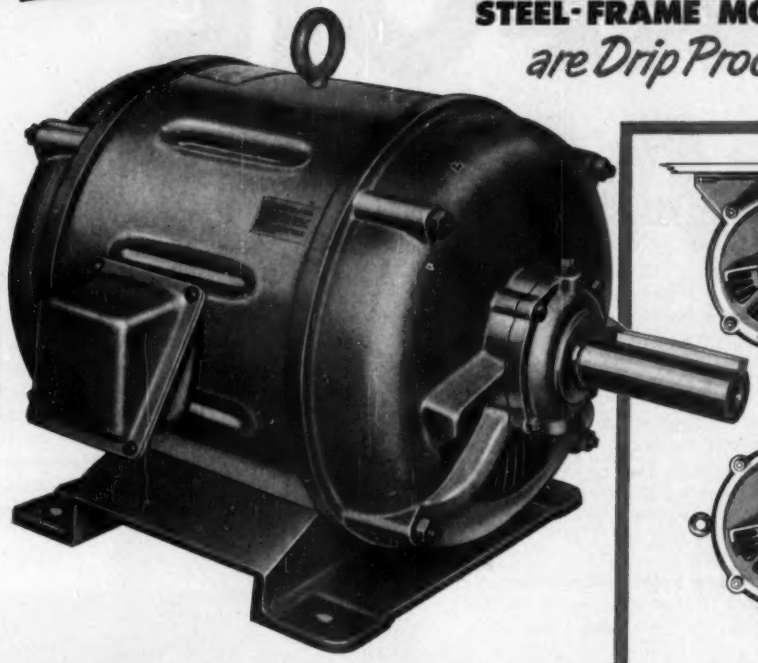
YOU CAN BE SURE...IF IT'S Westinghouse

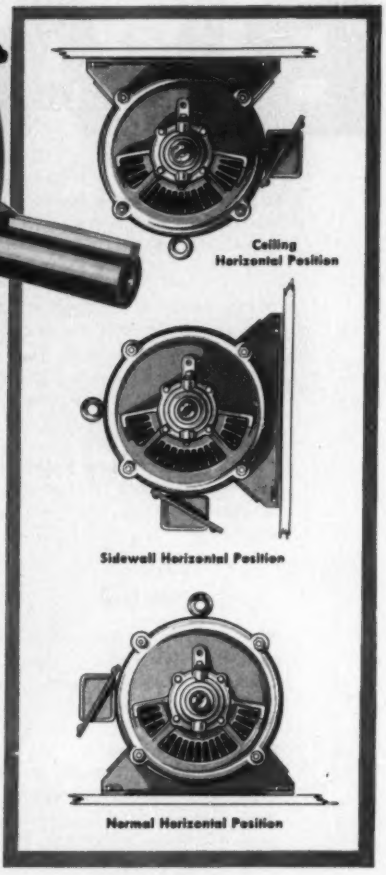
J-80244

Wagner
ELECTRIC MOTORS
...the choice of leaders in industry

Ceiling Mounted-Sidewall Mounted
or in normal horizontal position

Wagner
STEEL-FRAME MOTORS
are Drip Proof





and...they're *proved* by years of service.

Here's an open-type general purpose motor that's completely drip-proof in any horizontal position, in frames 326 and smaller, because there are no openings in the frame and the endplates can be rotated 90° or 180° for drip-proof installation on walls or ceiling.

These steel-frame, squirrel-cage motors have been *proved*—for long, useful, troublefree life by more than twenty years of hard usage in many industries. Wagner steel-frame motors are available with either sleeve or *ball bearings which may be relubricated*. The motor frames are formed of heavy rolled steel, shaped to accurately center the stator core and to provide passages for ample ventilation. An internal fan moves a large volume of cooling air through these passages to carry off heat from all parts of the motor.

Wagner Steel-Frame Motors are available in electrical types to meet most industrial requirements.

Bulletins give full information on the complete line of Wagner Motors. Thirty-one branches, located in principal cities, are ready to assist you whenever you have a motor problem. In addition, almost 650 authorized motor repair shops provide speedy, nationwide service facilities.

Wagner Electric Corporation
1891 WE 1951

WAGNER ELECTRIC CORPORATION
6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS – AIR AND HYDRAULIC

BRANCHES IN 31 PRINCIPAL CITIES

M51-18

BRUNNER SINCE 1906 REFRIGERATION helps you serve better

Maybe we can help if you are having trouble finding the units you need!

With 69 different models, types and capacities of refrigeration condensing units being built on regular production schedules in the Brunner plants, you have more assurance of getting exactly what you need, and when you need it, without wasting time hunting.

What's more, we offer you the help of experienced factory field men backed by an able engineering staff who have encountered and answered just about every kind of refrigeration or air conditioning problem imaginable.

With so much to offer folks engaged in the commercial refrigeration business, it just doesn't make sense to deprive yourself of the advantages that come with recommending and installing Brunner's as a regular habit.

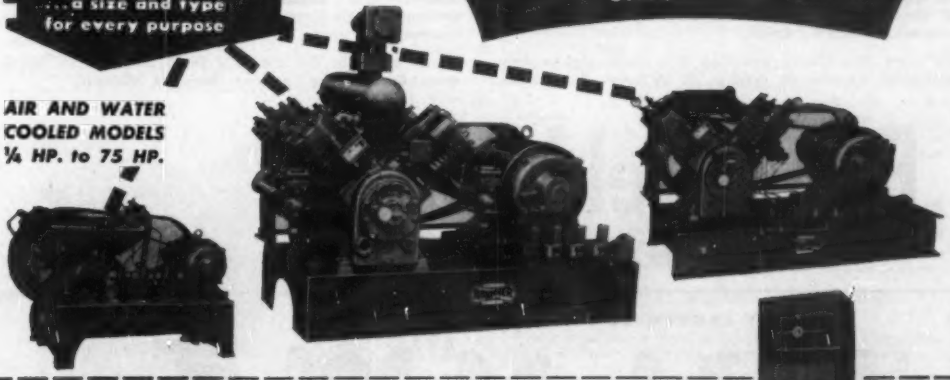
BRUNNER MANUFACTURING COMPANY, UTICA 1, N. Y., U. S. A.

P.S. *As a business man you should talk to a Brunner factory sales engineer. It costs nothing to listen, and you may discover that you have been missing a good bet. Your name and address written on the margin of this ad and mailed to us at Utica is all that is necessary.*

REFRIGERATION CONDENSING UNITS ....a size and type for every purpose

BRUNNER SINCE 1906

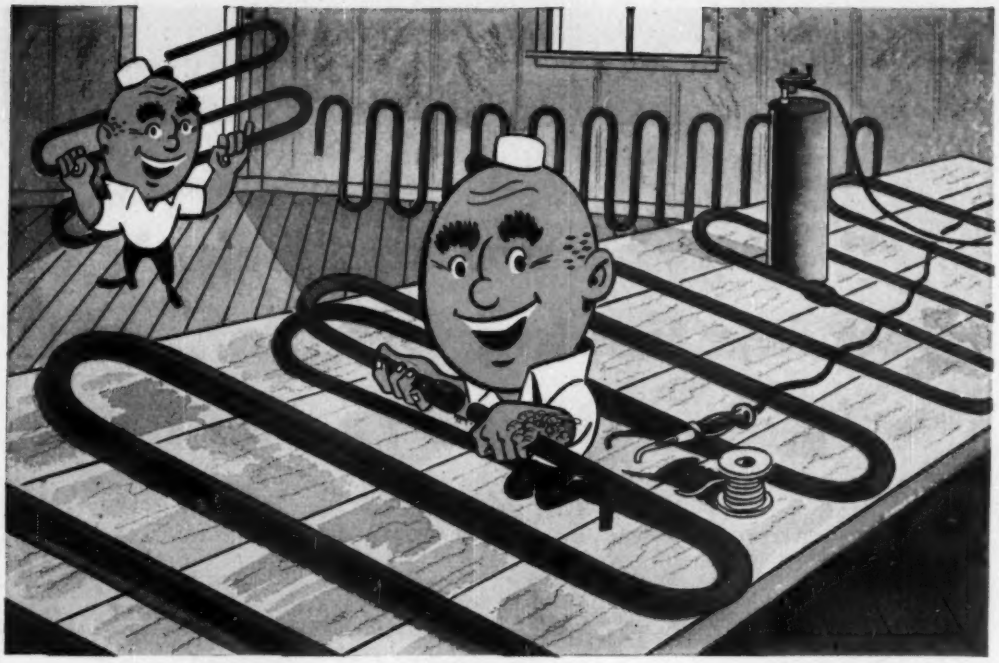
AIR AND WATER COOLED MODELS ¼ HP. to 75 HP.



BRUNNER SINCE 1906

AIR CONDITIONING

Self Contained Units in 4 sizes: 3-5-7½ and 10 HP.
Remote Installation Types from 3 to 75 HP.



Form radiant heating grids faster, too . . . with Bundyweld

NOTE that Bundyweld expanded end, above. It spells *even easier* radiant heating installation!

For twenty-foot lengths of Bundyweld Tubing can be sent to your building site with one end expanded (*if specified*). Then, one man quickly forms grid on simple fixture . . . slips unexpanded end into expanded end of the next grid, and silver brazes (or soft solders) grids into strong, permanent, leakproof union.

Two men can easily position the rigid, lightweight Bundyweld sections on ceilings or in floors. No hitches, delays. In jig time, your Bundyweld radiant heating system is all set, to the tune of a major savings in time and costs.

Bundyweld is double-walled from a single strip, copper-bonded through 360° of wall contact. It's stronger-walled, thinner-walled; bends more readily without collapsing structurally. Uniformity, even flow, maximum heat conductivity are yours!

Write today for the complete Bundyweld radiant heating story. ***Bundy Tubing Company, Detroit 14, Michigan.***

Bundyweld® Tubing

DOUBLE-WALLED FROM A SINGLE STRIP

WHY BUNDYWELD IS BETTER TUBING

Bundyweld starts as a single strip of basic metal, coated with a bonding metal. Then it's . . .

continuously rolled twice around laterally into a tube of uniform thickness, and

passed through a furnace. Bonding metal fuses with basic metal, presto—

Bundyweld . . . double-walled and brazed through 360° of wall contact.

NOTE the exclusive patented Bundyweld beveled edge, which affords a smoother joint, absence of bead and less chance for any leakage.

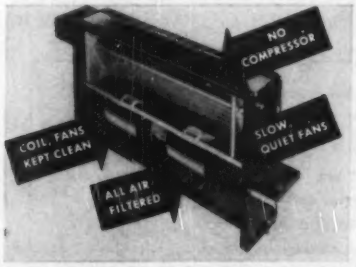
AIR CONDITIONING SYSTEMS *for* BUSINESS AND INDUSTRY

NEW DUN & BRADSTREET BUILDING in New York City has G-E Personal Weather Control Air Conditioning. Over 450 G-E room units circulate filtered, fresh air that is cool in summer, warm in winter. Architect: Reinhard, Hofmeister, & Walquist. Consulting engineer: Syska & Hennessy, Inc. General contractor: George A. Fuller Company. Air conditioning contractor: Kerby Saunders, Inc.

Cut first cost...and save in the long run, too, with

G-E PERSONAL WEATHER CONTROL

NO COMPRESSOR IN ROOM UNITS, just quiet, velvet-smooth fans and G-E motor. Room occupants can set temperature as they like without disturbing others. Units are supplied with attractive cabinets (above) or can be concealed in walls. Windows are never blocked.



ALL AIR FILTERED, protecting coils from dust which cuts performance drastically. Filters — inexpensive, changed in less than a minute—reduce room cleaning, avoid costly coil cleaning. Nine-inch deep unit takes little space, circulates air gently through large area.

HERE IS an air conditioning system that in most cases costs less to install...and goes on piling up savings for its owner through many years of operation.

It's General Electric Personal Weather Control, which heats in winter and cools in summer...utilizing individual G-E room air conditioners supplied with hot or chilled water through simple pipe runs from a central heating and refrigeration plant.

HOW YOU SAVE...Valuable space can be saved and alterations can be avoided by supplying ventilation through small-size ducts, the method used in the new Dun & Bradstreet Building (above) in New York City. Installation costs can be reduced even further by installing these systems with no ducts at all...using wall apertures for fresh air.

G-E Personal Weather Control often requires substantially less compressor capacity, saving both installed and operating cost. When rooms are unoccupied, units can be shut off. When there are few people in the building or the system is being started in the morning, units can be operated without the expense of running ventilation equipment.

MAKES YOUR BUILDING MORE PROFITABLE...Tenants enjoy living or working in buildings air conditioned by G-E Personal Weather Control. Each tenant can set the temperature of his room without disturbing others. And it's easier to rearrange office space, because G-E room units are flexible.

It's no wonder that G-E Personal Weather Control Air Conditioning is installed in Houston's Sterling Building ...12 Sheraton Hotels...the prominent new 575 Madison Avenue Building in New York City...and other leading buildings all over the United States.

GENERAL ELECTRIC

FREE DATA to architects, engineers, builders, contractors, and building owners.

General Electric Company, Air Conditioning Dept., Sec. HP-9, Bloomfield, N. J.

Please send me, without obligation, detailed information on G-E Personal Weather Control Air Conditioning.

NAME.....

COMPANY.....

ADDRESS.....

CITY.....ZONE.....STATE.....

Today, the steel business is your business

—*it needs all your SCRAP, Now!*

SUPPOSE that every steel user were suddenly told that he had to turn in a half-ton of scrap before he could get a ton of steel. It would start the most gosh-almighty treasure hunt for scrap that ever happened.

In effect, this "no-scrap, no-steel" situation virtually exists. For without *all* the scrap that industry can search out and start on its way to the mills, steel production will surely drop. It's as serious as that.

More scrap is urgently needed. Today the mills are turning out more steel than ever before. But they're scraping the bottom of the barrel as far as scrap is concerned. Defense and domestic demands for steel simply cannot be met unless at least 100,000 tons of "purchased" scrap roll into the furnaces—*every day*.

The bulk of this scrap must come from industry. That's why we're asking for your all-out help. That's why it's so important that you make the drive for scrap part of your daily operations. Make it your business to encourage every employee to report any obsolete, broken or worn-out machinery, tool or equipment that has seen its day. From this dormant "junk" must come the heavy melting scrap that the mills need most. Don't let your scrap lie idle; send it on its way. How about it, pardner?

You'll find your local scrap dealers listed in the yellow pages of the phone directory.

This page would ordinarily be used to tell you about

U·S·S GALVANIZED STEEL SHEETS

but, because without SCRAP we cannot produce steel, we are asking instead for your all-out help in getting more SCRAP to the mills.

COLUMBIA STEEL COMPANY, SAN FRANCISCO
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM · UNITED STATES STEEL COMPANY, PITTSBURGH
UNITED STATES STEEL SUPPLY COMPANY, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

1-1338

UNITED STATES STEEL

How an Engineer Slashed Operating Costs 46% with coal!

Fred Koenig's notes *(below)* were incorporated in his report to the Wagner Brewing Co., Columbus, Ohio in October, 1951.

IN FIRST YEAR OF OPERATION, NEW POWER PLANT EVEN BETTERS FRED'S ESTIMATE!

Fred Koenig calculated a saving of $40,000. When the figures were in—after the first full year of operation—the saving actually amounted to $44,730!

Here's the coal-fired installation that engineer Koenig recommended, after carefully considering gas and oil as fuels. Specifically designed to get the most energy from today's coals, it saved the Wagner Co. $22,730 on fuel alone in the first year!

This large-capacity silo feeds coal automatically to the Wagner Company's power plant. It cuts handling costs—permits bulk buying of coal at lower rates—assures the Wagner Company of a steady, dependable source of power!

* * *

Cost of new power plant	$128,000
Coal tonnage (old plant)	8,420
Coal tonnage (new plant)	4,700
Fuel costs (old plant)	$ 54,730
Fuel costs (new plant)	$ 32,000
Yearly savings on fuel	$ 22,730
Labor costs (old plant)	$ 41,496
Labor costs (new plant)	$ 19,496
Reduction in present labor costs	$ 22,000
Yearly savings	$ 44,730

Amortization time, new power plant—2 years, 11 months.

Fred W. Koenig
CHIEF ENGINEER
OHIO LICENSE

Today, bituminous coal, when used with modern equipment, is the most economical fuel for industrial use. Coal is now more efficient because it's *prepared* . . . cleaned of all impurities. Modern equipment adds from 10% to 40% to the power obtained from the same amount of coal in years gone by.

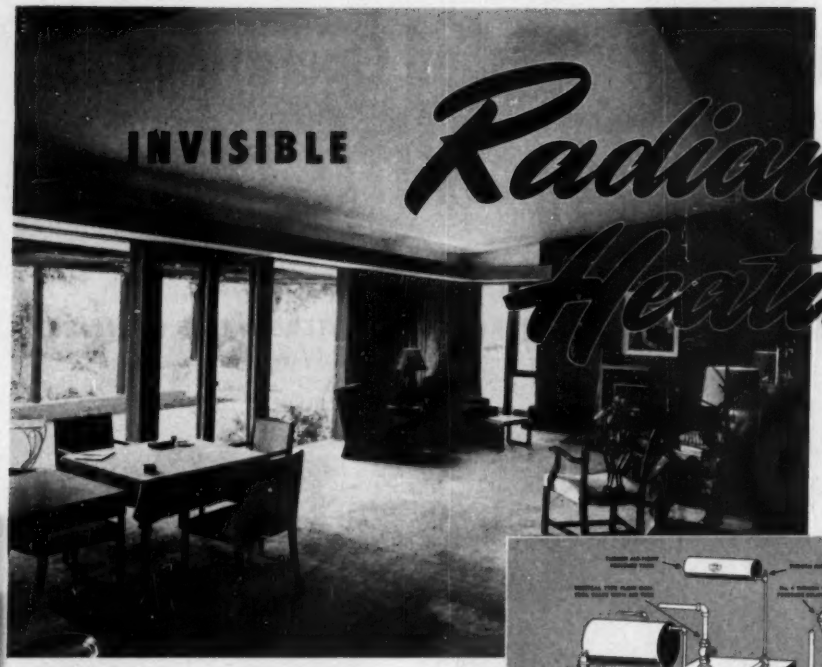
And automatic controls, together with modern coal- and ash-handling apparatus, have dramatically reduced labor costs, done away with inconveniences—*making bituminous coal the best industrial fuel by far!*

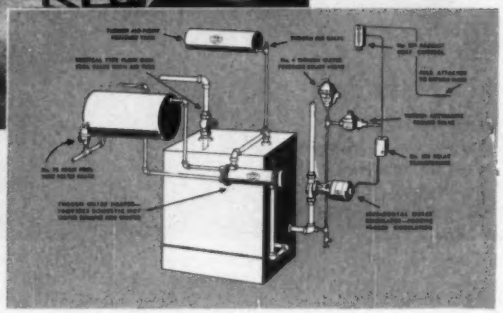
America's coal mines are so productive that there will be no shortages to plague the companies that use coal for power . . . America's ample supply of coal is the best possible assurance that the price of coal will remain more stable than those of other fuels. Coal is always the safest fuel when it comes to both storage and use, factors of more than usual importance in these unsettled times.

BITUMINOUS COAL INSTITUTE
A Department of National Coal Association, Washington, D. C.

FOR HIGH EFFICIENCY FOR LOW COST

YOU CAN COUNT ON COAL!





forced circulating

THRUSH FLOW CONTROL

HOT WATER HEAT

THRUSH hot water heating system is flexible. With forced circulation and completely automatic control you can install any type of modern heating your customers desire and be sure of complete satisfaction. Heat from radiant coils hidden in ceiling or floor, radiant baseboards or convectors, with Thrush Flow Control System provide perfect comfort without overheating, automatically compensating for weather changes. Zoning is simple and inexpensive. Get all the facts on profitable Thrush equipment now. See your wholesaler today or write Dept. E-12.

THRUSH HORIZONTAL WATER CIRCULATOR

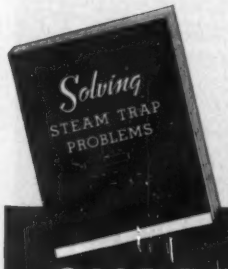
THRUSH

H. A. THRUSH & COMPANY

PERU • INDIANA

● Super-Silvertop Steam Traps pay for themselves because they are installed and serviced so much faster and easier than any other trap. Look how the Super-Silvertop design provides for 3 pipe connections in the head so that you can easily install the trap as an elbow or straight-in-line. This feature, standard on all Super-Silvertops, eliminates "jungle" piping that accompanies traps with only 2 pipe connections . . . actually saves up to 7 fittings plus 50 minutes installation time over conventional traps.

Good preventive maintenance calls for periodic steam trap inspection. To inspect any Super-Silvertop, you simply loosen and remove the body . . . no pipe fittings to disconnect before you can get to the inside of the trap. These two features, plus the patented guided bucket that eliminates sloppy bucket action and damage, are the reasons why more and more plants are standardizing on Super-Silvertops. Buy the trap that pays for itself. See your local Super-Silvertop distributor about selecting the right trap for your requirements.

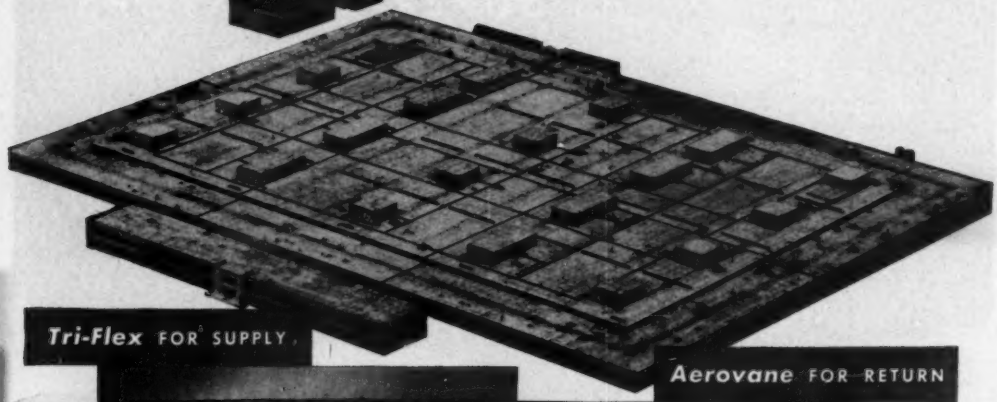


***FREE** THIS FAMOUS SUPER-SILVERTOP BOOK is yours for the asking. Explains how to select the right steam trap for any installation. Many useful maintenance helps. Write for your copy of "Solving Steam Trap Problems" today.*

THE V. D. ANDERSON COMPANY
1949 WEST 96TH STREET • CLEVELAND 2, OHIO
In Canada: Bawden Industries, Ltd., Toronto

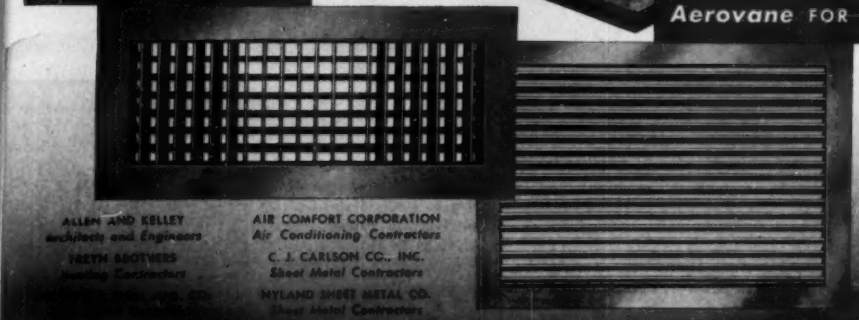
SUPER-SILVERTOP STEAM TRAPS

Tri-Flex . . . Aerovane . . . in the Western Electric Company Indianapolis Plant



Tri-Flex FOR SUPPLY

Aerovane FOR RETURN



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Architects and Engineers

FRETH BROTHERS
Heating Contractors

AIR COMFORT CORPORATION
Air Conditioning Contractors

C. J. CARLSON CO., INC.
Sheet Metal Contractors

MYLAND SHEET METAL CO.
Sheet Metal Contractors

In outstanding buildings from coast to coast where air conditioning is important to improved working conditions or customer comfort . . . or essential to manufacturing processes, as it is in the new Indianapolis Plant of the Western Electric Company . . . you'll find Tri-Flex and Aerovane Grilles and Registers installed at the all-important distribution end of the systems. The engineers, architects and contractors — the men responsible for the efficient performance of these jobs — know from experience they can depend on the Tri-Flex and Aerovane combination to insure the maximum, flexible control of air delivery necessary to meet the most exacting requirements.

Be wise, standardize . . . with T & B Standards.*

TUTTLE & BAILEY INC

NEW BRITAIN, CONNECTICUT

today's best buy is better air!

Type N ROTO-CLONES exhausting grinding and buffing operations.

ROTO-CLONES
control grinding and buffing dust!

The four Type N ROTO-CLONES* shown above are only a part of the total number installed in this large automotive parts manufacturing plant to control the difficult dust problem created by grinding and buffing operations.

The Type N ROTO-CLONE is a dynamic precipitator of the hydro-static type. It exhausts, collects and stores dust... in the form of sludge... within one compact, self-contained unit. High efficiency dust and fume removal is obtained by the Type N's dual washing and scrubbing action. This removes both coarse material and extreme fines from the air stream, even in excessive concentrations. Water curtains induced by air flow eliminate pumps, nozzles and all moving parts.

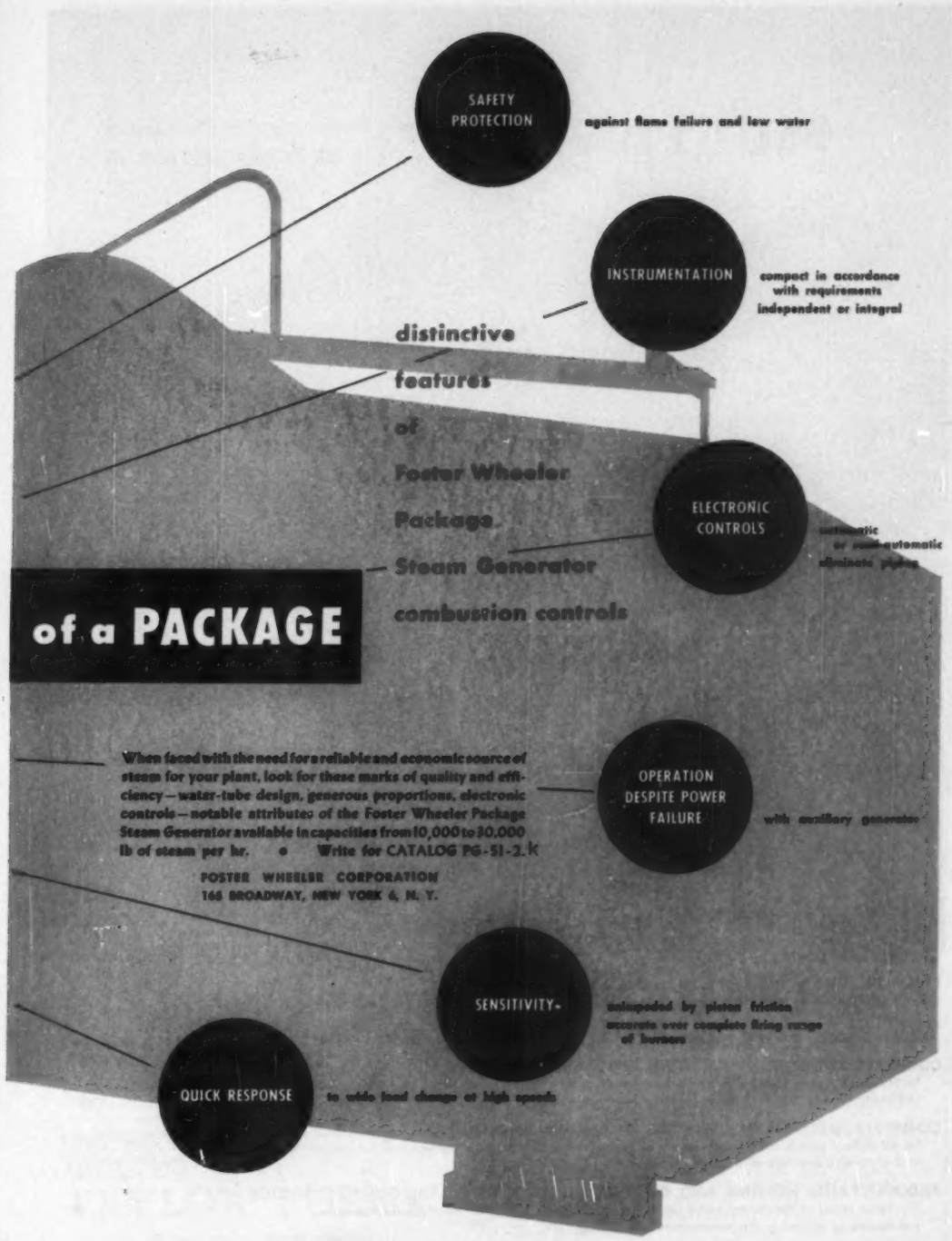
The Type N ROTO-CLONE maintains peak efficiency without interruptions for reconditioning or service. Also uniform air delivery assures sufficient air flow at hoods and unvarying velocities in branch pipes and main ducts at all times.

The complete line of AAF ROTO-CLONES offers a wide selection of performance and operating characteristics that will efficiently control every dust source. For the correct solution to your dust or air pollution problem call your nearby AAF representative or write direct to us.

**ROTO-CLONE is the trade-mark (Reg. U.S. Pat. Off.) of the American Air Filter Company, Inc., for various dust collectors of the dynamic precipitator and hydro-static precipitator types.*

AAF **American Air Filter**
COMPANY, INC.
373 Central Avenue, Louisville 8, Kentucky • In Canada: Darling Bros., Ltd., Montreal, P. Q.

FULLY AUTOMATIC
• push-button start
• operation at all pressures up to design pressure
all for the price
SEMI-AUTOMATIC
• manual ignition
• wide operating range
• modulating control


SAFETY PROTECTION
against flame failure and low water
INSTRUMENTATION
compact in accordance with requirements independent or integral
distinctive features of Foster Wheeler Package Steam Generator combustion controls
ELECTRONIC CONTROLS
automatic or semi-automatic eliminate piping
of a PACKAGE
When faced with the need for a reliable and economic source of steam for your plant, look for these marks of quality and efficiency—water-tube design, generous proportions, electronic controls—notable attributes of the Foster Wheeler Package Steam Generator available in capacities from 10,000 to 30,000 lb of steam per hr. • Write for CATALOG PG-51-2.k
FOSTER WHEELER CORPORATION
165 BROADWAY, NEW YORK 6, N. Y.
OPERATION DESPITE POWER FAILURE
with auxiliary generator
SENSITIVITY-
unimpeded by piston friction accurate over complete firing range of burners
QUICK RESPONSE
to wide load change at high speeds

FOSTER WHEELER

MULTI-VENT

T.M. Reg. U.S. Pat. Off.

Low Velocity Air Diffusion CEILING PANELS

in Pittsburgh's

GATEWAY CENTER BUILDINGS

Multi-Vent panels have been specified throughout for diffusing both cooled and heated air in all the interior bays of the first three office buildings, now under construction.

Eggers & Higgins, Architects
Irwin Clavan, Architect
Meyer, Strang & Jones, Consulting Engineers

Selected for . . .

TRULY DRAFTLESS, NOISELESS AIR CONDITIONED COMFORT . . .
for over 8000 office workers, summer and winter.

Plus these great advantages possible only with Multi-Vent...

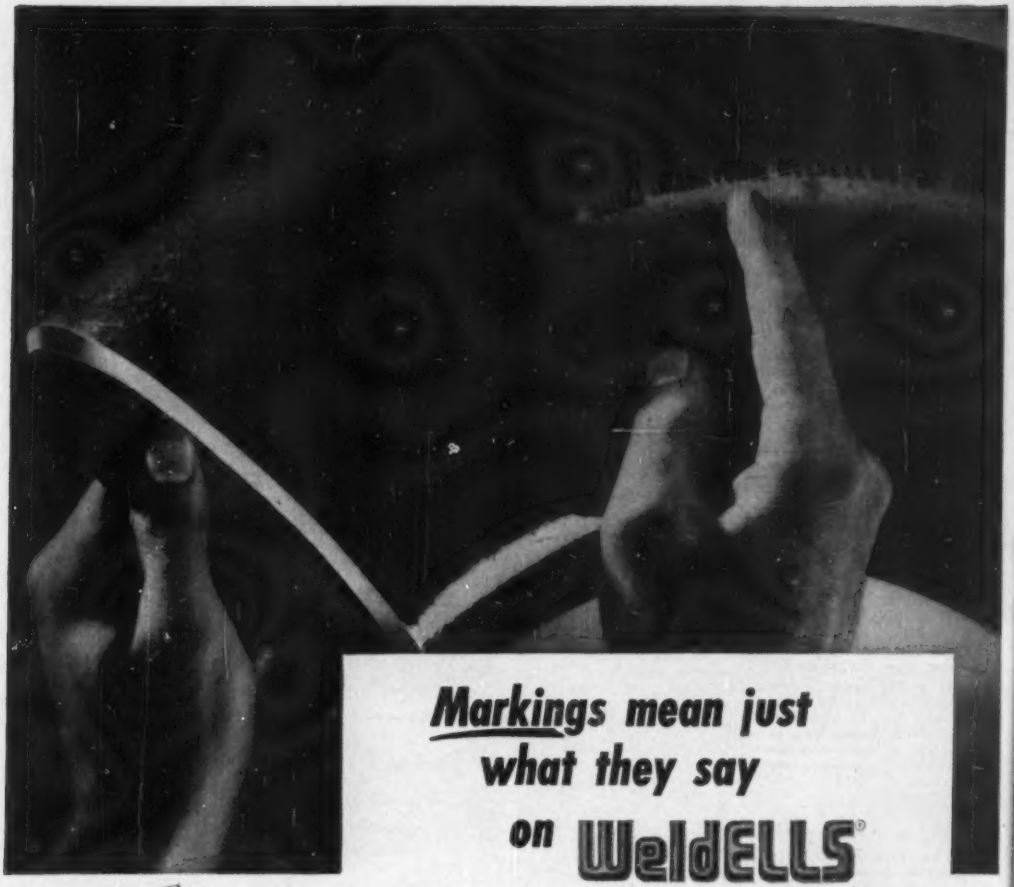
COMPLETE FREEDOM IN LOCATING MOVABLE PARTITIONS
Partitions may even bisect a diffusing panel without disturbing in any way Multi-Vent's incomparable over-all uniformity of room air movement, temperature, and humidity.

COMPLETE FREEDOM IN LOCATION OF LIGHTING FIXTURES . . .
for Multi-Vent panels are completely concealed in standard acoustical ceilings, and in no way interfere with interior design.

See SWEET's Arch. & Eng. files or write for detailed literature.

RADIANT PANEL HEATING AND COOLING EFFECT ADDS TO THE COMFORT FACTOR
The large areas of the ceiling which function as distribution plates for the Multi-Vent panels are heated or cooled to the temperature of the supply air.

MULTI-VENT DIVISION **THE PYLE-NATIONAL COMPANY**
1373 North Kostner Avenue Chicago 51, Illinois



Markings mean just what they say on WeldELLS®

A VOLUME OF USEFUL DATA ON A SINGLE SHEET—Sizes, thicknesses and dimensions of all commonly used WeldELLS and Taylor Forged Steel Flanges ingeniously condensed on a heavy durable, letter-sized card. Indispensable for piping men. Coupon brings free copy.

No other fittings for pipe welding are so true to their markings as WeldELLS — so absolutely uniform, mechanically, metallurgically, dimensionally.

It would be bad business for us to say this if thousands of users had not already said it for us and to us. "There are no bad ones" is nearly always the foremost reason given by practical men for insisting on WeldELLS.

Pick up any WeldELL and check it against the tabulation of its size, wall thickness, and other dimensions. It will be right on the head. And it will be right on the head in plus-value features, too—features that are combined in no other fittings.

Remember that the finest line of welding fittings is also the broadest line. Coupon brings your copy of useful data described below.

TF

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS

General Offices and Works: P. O. Box 485, Chicago 90, Ill.
Offices in all principal cities
Plants at: Carnegie, Pa.; Fontana, Calif.; Hamilton, Ont., Canada

Please send a copy of your data sheet covering Taylor Forge Welding Fittings and Forged Steel Flanges.

NAME_____

POSITION_____

COMPANY_____

STREET ADDRESS_____

CITY_____ ZONE____ STATE_____

510-1251 Mail to Taylor Forge & Pipe Works, P. O. Box 485, Chicago 90, Ill.

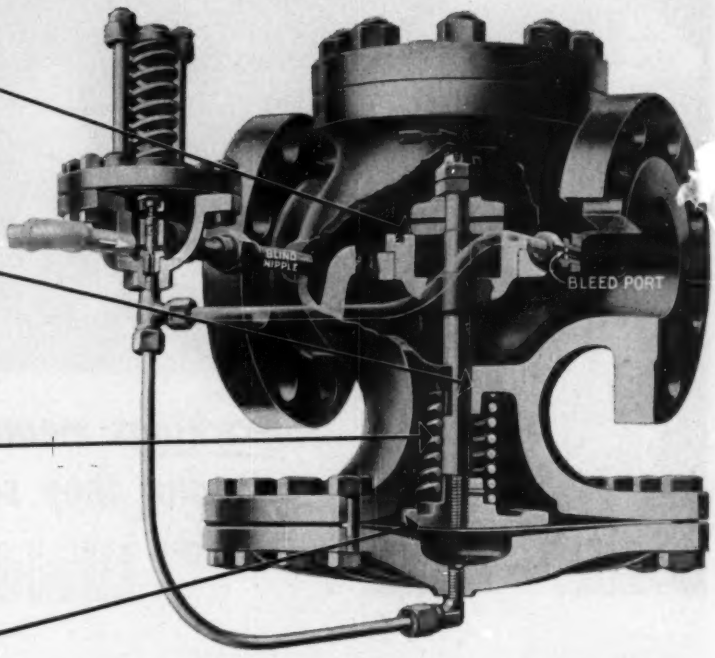
WHY Spence Regulators Outlast The Field

SECO METAL SEATS AND DISCS — Durable SECO Metal resists wiredrawing. More than *twenty years of experience* in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

PACKLESS CONSTRUCTION — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

SPRING OUT OF PATH OF STEAM — The spring in the Spence Regulator is out of the path of the steam or other fluid flowing through the valve. It operates at low unit stress for exceptionally long life.

LARGE BALANCED DIAPHRAGM—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.



Spence Type EQ back pressure regulator — operation of main valve is controlled by a sensitive pilot to regulate the initial pressure. Same pilot is used with all sizes of main valves.

The features shown above explain why you profit on every important count with Spence Pressure and Temperature Regulators.

Learn more about these and many other advantages of Spence Regulators by sending for Bulletin 350.

DURABILITY — Spence Regulators perform dependably year after year.

ACCURACY — You can be sure of accurate control for the life of the regulator.

MAINTENANCE — You don't need expensive repairs or special maintenance. That means less down-time, less time and money wasted on replacement of parts.

SR-110

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

Spence

RIC·WIL GIVES YOU

3-WAY EFFICIENCY

...IN SYSTEM DESIGN
...IN FAST INSTALLATION
...IN PEAK PERFORMANCE

When you have an insulated piping problem, remember that only the best will give you ALL the advantages necessary to full-efficiency performance of your system. That means Ric-wiL Prefabricated Insulated Piping.

Ric-wiL provides all the factors that insure (1) top-efficiency system design; (2) fast, economical installation; (3) the right protection and insulation for the job.

Ric-wiL maintains a competent Piping Engineering staff for assistance to architects, engineers, and contractors in the planning of insulated piping systems and preparation of accurate, time-saving installation drawings.

Ric-wiL prefabricated straight sections and complete line of accessories provide fast, economical installation by eliminating the many inefficiencies of field fabrication of insulating and protective materials.

Peak operating performance is constantly insured in Ric-wil systems by the fine material and workmanship used in producing Ric-wil products. From the raw material stage through every phase of fabrication, skilled craftsmen build into Ric-wil piping every known component for long, efficient operating life.

And remember this . . . only Ric-wil provides *all* the features necessary to maximum protection, insulation, and high efficiency operation of underground or overhead insulated piping systems.

The Ric-wil representative nearest you will be glad to give you full information on Ric-wil as applied to your problem. If you prefer, write to Dept. 14-OA at Cleveland, Ohio, for full technical information.

40th YEAR DEPENDABLE INSULATED PIPING SYSTEMS SINCE 1912

RIC·WIL

INSULATED PIPING SYSTEMS

THE RIC-WIL COMPANY · CLEVELAND, O.

OVERHEAD — UNDERGROUND

FOR FORTY YEARS THE GREATEST NAME IN INSULATED PIPING SYSTEMS

Peak Pump Performance

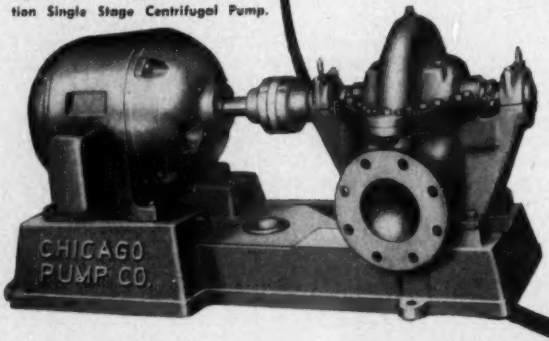
ALWAYS FLOWS FROM CHICAGO TYPE N and TYPE D CENTRIFUGALS

Figure N8927—Type N Close Coupled Pump.

Type N Close Coupled Pump

Compact and sturdy. Designed to handle the toughest pumping jobs efficiently and in the least possible space. A precision built mechanical seal on the shaft requires no adjustment and eliminates dripping. Available in seven frame sizes with capacities up to 500 G.P.M. and heads up to 215 ft. Write for Bulletin 108.

Figure H8111—Type D Double Suction Single Stage Centrifugal Pump.



Type D Double Suction Single Stage Pump

For house pump, fire and booster service this pump combines the best materials available with the skilled craftsmanship found in every Chicago pump. Available in thirteen frame sizes for capacities up to 1900 G.P.M. and heads up to 530 ft. Write for Bulletin 101.

CHICAGO PUMP COMPANY

BUILDING and INDUSTRIAL DIVISION

2300 WOLFRAM STREET — **CHICAGO 18, ILLINOIS**

Condo-Vac, Sure Return, AVC, LVC, Fire, House & Circulating Pumps Pneumatic & Tankless Water Systems

Flush-Kleen Sewage Ejectors Little Giant & Non-Clog Bilge Pumps Pumps for every industrial use.

Century 1 TO 400 H.P. MOTORS

Choose From These Many Types To Fit Your Job

DEPENDABLE CONSTRUCTION . . . Plus

PROPER SELECTION MINIMIZE SHUTDOWNS

Century Electric Company is celebrating its 50th year in the electrical industry.

It's easy to select the proper electric motor for your job from Century's complete line — from 1/6 to 400 horsepower. A wide range of types and kinds are available to satisfy all popular requirements. They are carefully designed, built and tested to assure maximum performance throughout their long life.

Here are examples of Century's line of INTEGRAL HORSEPOWER motors.

Polyphase

TYPE SC—Open Drip proof General Purpose Motor. Meets the needs of most installations where operating conditions are relatively clean and dry.

TYPE SC—Splash proof. Supplies protection where plants must be washed down. Keeps out all falling or splashing liquids—rain, snow, sleet, etc.

TYPE SC—Totally Enclosed Fan Cooled. Protects against dusts, mist, oil, fog. Inner frame protects vital parts of the motor, seals out harmful matter.

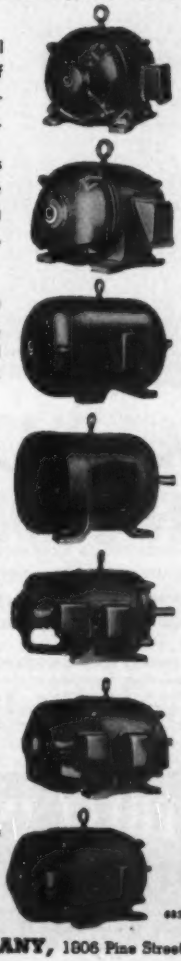
TYPE SC—Explosion proof. Protects life and property in atmospheres charged with explosive dusts or gases.

TYPE SR—Wound Rotor. Open Construction. Ideal for applications requiring low starting current with high starting torque, reversing or adjustable speed.

TYPE SR—Wound Rotor Splash proof. Same electrical characteristics as motor shown above. In addition, gives adequate protection against falling and splashing liquids.

Single Phase

TYPE RS—Repulsion Start Induction, Open Construction, Single Phase Brush Lifting Motor. Combines high starting torque with low starting current.



TYPE RS—Splash proof. Same advantages as open construction, plus protection against splashing and falling liquids.

TYPE CSH—Capacitor Start Induction, Single Phase Motor. Suitable when high starting torque with normal starting current is satisfactory.

TYPE CSH—Splash proof. Same advantages as motor shown above, plus protection against falling and splashing liquids.

Direct Current

TYPE DN—Direct Current Motors. Suitable for use where direct current is available, or its use desirable.

TYPE DN—Direct Current, Splash proof.

TYPE SY—Synchronous. Suitable for continuous operation at a uniform load for power factor correction.

In addition to a complete line of integral horsepower motors, Century offers fractional horsepower motors, gear motors, generators, AC and DC motor generator sets.

For a long life of satisfactory performance, specify Century motors for all your electric power requirements.

CENTURY ELECTRIC COMPANY, 1806 Pine Street, St. Louis 3, Missouri • Offices and Stock Points in Principal Cities

We have been asked:

"How would you insulate a cold air duct while a 35° room is under refrigeration?"

We recently received a letter that asked the following question:

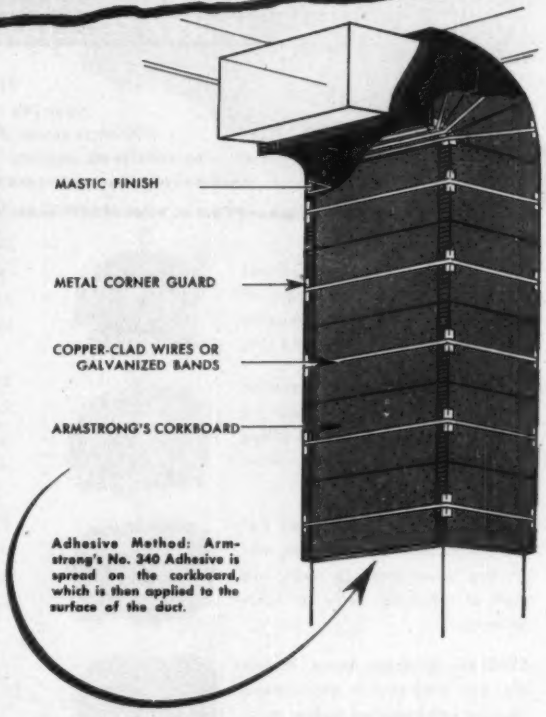
"A duct which runs through one of our 35° storage rooms carries cold air at a temperature below the dew point of the room. We are troubled with condensation on the duct and would like to insulate it without taking the room out of service. How would you insulate and finish this duct?"

To answer this question we sent the specification illustrated at the right. It shows the adhesive method of applying Armstrong's Corkboard to cold air ducts. After the duct has been cleaned, Armstrong's No. 340 Cement is spread on the corkboard with a notched trowel, and the insulation is then applied to the duct.

Because the 35° temperature would stiffen the adhesive and make trowelling difficult, we suggested that it be applied outside the room. The corkboard could then be carried in and secured in place with copper clad wires or metal bands on 12" centers over metal corner guards. For ducts greater than 3' in any one dimension, metal bands should be used. Bands on the bottoms of ducts wider than 6' should be secured to metal fasteners attached to the center of the duct with a suitable adhesive. Sheet metal screws may also be used.

We also suggested, in this case, that the insulation be Armstrong's Mastic-Finish Corkboard. This product has an asphalt mastic finish ironed on at the factory and eliminates the need for applying a finish in the 35° room.

Whenever you're planning an insulation job, contact an Armstrong engineer. He has a thorough understanding of all phases of insulation work, and his practical advice takes into account every individual problem of the job at hand. In addition, Armstrong's Contracting Service will furnish you with top-quality materials and the skilled workmen to apply them properly. Just call your near-by Armstrong office.


MASTIC FINISH
METAL CORNER GUARD
COPPER-CLAD WIRES OR GALVANIZED BANDS
ARMSTRONG'S CORKBOARD
Adhesive Method: Armstrong's No. 340 Adhesive is spread on the corkboard, which is then applied to the surface of the duct.

SEND US YOUR QUESTIONS. If you have any questions on insulating materials or their use in low-temperature installations, please write us. We'll see that you get a prompt, practical answer. Address your letter or post card to Armstrong Cork Company, 4412 Concord St., Lancaster, Pennsylvania.

ARMSTRONG'S INDUSTRIAL INSULATIONS

THE MONTCLAIR IN ST. LOUIS CHOOSES MODINE

In St. Louis' new Montclair apartments, 200 families will enjoy Modine Convector Radiation. Architect: Rosario Candela-Paul Resnick, N.Y.C. Consulting Engineers: George E. Wells, Inc., St. Louis. Heating Contractor: Joseph E. Barry, Inc., St. Louis, Mo.

THE MONTCLAIR
Another CAMPAGNA Structure
Lancamp Realty Corp.
New York — St. Louis
Builders and Owners

AMERICA'S FINEST BUILDINGS USE AMERICA'S FINEST CONVECTORS

Modine Convectors come in three distinctive enclosures — Type F (shown) for free-standing or recessed installation, Types W and S for wall-hanging.

More and more Modine Convectors are being specified to meet the high standards of excellence demanded of modern heating equipment.

There are sound reasons for this popularity. Foremost is *quality* . . . proved by the universal acceptance which Modine Convectors have enjoyed among architects and engineers for more than twenty years.

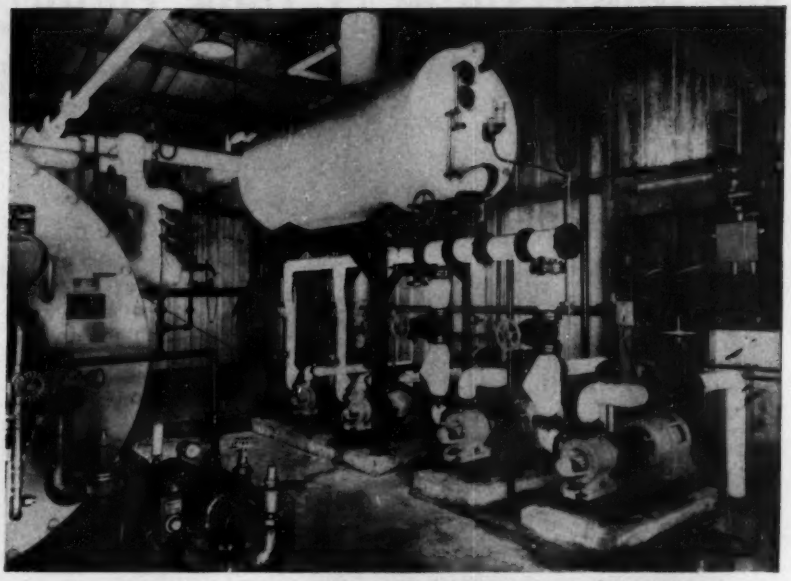
With Modine, quality is no idle catchword. It's *real* . . . a result of sound engineering — highest grade materials — advanced manufacturing techniques — skilled craftsmanship — and a rigid quality-control program.

To measure this quality, personally inspect a Modine Convector on the job or in your office. Talk with owners. You'll find unmatched styling — superior enclosure and heating unit construction — longer life — and better heating performance.

Call your Modine representative listed in your classified phone book, or write Modine Mfg. Co., 1509 DeKoven Ave., Racine, Wis.

R-1114

Modine CONVECTORS

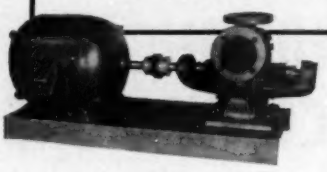


Schaub Duplex Deaerator System, installed in a new Pacific Northwest plant, handling one 100 H.P. and one 800 H. P. packaged boilers, 150 lbs. working pressure.

You Get **MORE** in a **SCHAUB**

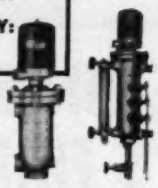
BOILER RETURN SYSTEM

THIS EXCLUSIVE COMBINATION OF *"Plus Values"* TELLS WHY:



Schaub Master-Bilt Turbine Pump

Patented fleximatic shaft seals and prelubricated ball bearings mean no packing and no greasing — *ever!* When you install a Schaub Master-Bilt Pump you can forget about it.



Ultra-Dependable MAGNETROL Boiler Water Level Control

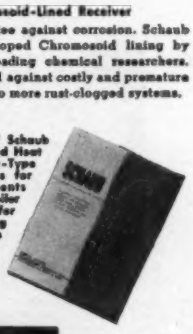
Combination pump control and low water safety cut-off. Friction-free Magnetrol assures boiler safety. No bellows to stiffen, no packing in head, no tricky electrode circuits to fail. All models approved by Underwriters' Laboratories, Inc.

Chromesoid-Lined Receiver

10-year guarantee against corrosion. Schaub engineers developed Chromesoid lining by working with leading chemical researchers. You're protected against costly and premature replacements. No more rust-clogged systems.

Each of these, along with other features, combine to produce the high overall efficiency, economy and long-lasting service characteristic of every Schaub System. Operators who buy on the basis of facts and performance find that they get more out of a Schaub System because a Schaub System has *more to give them.* When a Schaub System is compared with any other, the *least* difference is the difference in price! That's just another way of saying *you pay less per year for a Schaub System.*

Know the Facts! Schaub also builds Patented Heat Reclaim and Spray-Type Deaerating Systems for exacting requirements from 10 to 1000 boiler horse power. Write for new Schaub Catalog No. 55 which gives more information on all types of Schaub Systems.



FRED H. SCHAUB ENGINEERING CO.

2116 S. Marshall Boulevard • Chicago 23, Illinois

Air conditioning drive

CROCKER-WHEELER
Protected-Type MOTORS

. . . for Macy's big modernized Kansas City store!

This fine new merchandising unit has set the pace in department store modernization. It is significant that Elliott Crocker-Wheeler protected type wound-rotor induction motors were selected to drive the freon compressors in the all-over air conditioning system. These motors, immune to the ordinary effects of moisture, oil, dust and grit, incorporate many quality features insuring dependable service.

Good buildings everywhere are served by these tough Crocker-Wheeler motors — because engineers and contractors know they are safe in specifying them.

Here's the story on building motors

In this bulletin, the story of Elliott-Crocker-Wheeler squirrel cage and wound rotor induction motors, in NEMA frame sizes, is briefed to a minimum. Send for it. For quick response, address your request to

ELLIOTT COMPANY
Dept. H, Jeannette, Pa.

HALF CENTURY OF 1901 EC 1951 POWER PROGRESS

CW-88

ELLIOTT COMPANY

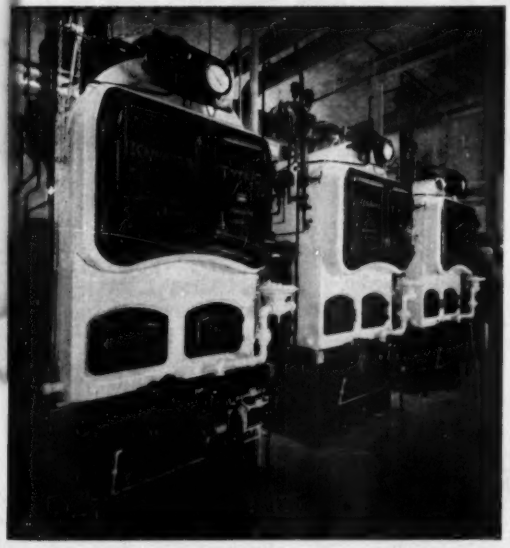
CROCKER-WHEELER DIVISION
Ampere, N. J.

BRANCH OFFICES AND REPRESENTATIVES IN PRINCIPAL CITIES
ELLIOTT *Approved* SERVICE SHOPS COVER THE COUNTRY

GENERAL OFFICES & MAIN PLANT—JEANNETTE, PA.

KEWANEE
STEEL BOILERS

The PARK MERCED Apartments, San Francisco, Calif.
LEONARD SCHULTZE and ASSOCIATES,
New York, Architects
THOMAS B. HUNTER, Engineer
SCOTT-HASTORF-NETTLES, Inc., Heating Contractor



One of the 11 Boiler Rooms in the Park Merced . . . each equipped with 3 Kewanee Type "C" Boilers. Each of these Kewanees is rated at approximately 2,500,000 Btu hourly . . . a total of more than 80 million for the entire project.

11 Boiler Rooms—3 Boilers in each—33 Boilers . . . all of them *KEWANEES* . . . were selected to heat this modern group of apartments erected by the Metropolitan Life Insurance Company. Here is the second large project in San Francisco's famous Lake Merced Section which has choosen Kewanee for dependable economical heat.

Providing living accommodations for large masses of people is the building industry's number one problem today. For America's standards of living have been raised to such an extent that the best is demanded though rents are at moderate or even low levels. The only solution is to keep operating costs down and Kewanee Boilers do that job to perfection.

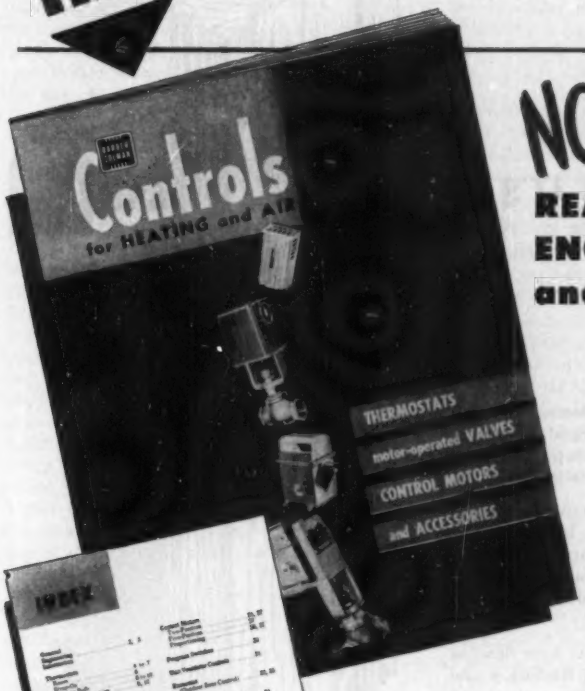
Because the unusual dependability and long life of Kewanee Boilers spread their initial cost over many extra years, they are *most economical to buy.* And ability to save fuel money year after year makes them *most economical to operate.*

KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS
Eastern District Office: 40 West 40th Street, New York City 18
Division of American Radiator & Standard Sanitary corporation

BUILDING BETTER BOILERS OVER 80 YEARS

Serving home and industry
AMERICAN STANDARD · AMERICAN BLOWER · CHURCH SEATS · DETROIT LUBRICATOR · KEWANEE BOILERS · ROSS HEATER · TONAWANDA IRON

this big 48 page catalog...



BARBER COLMAN

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Send for your copy of "Controls for Heating and Air Conditioning" today. Here in one compact, clearly indexed catalog is all the information you need on Barber-Colman . . .

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Please rush..... copies of your new 48-page Catalog "Controls for Heating and Air Conditioning."

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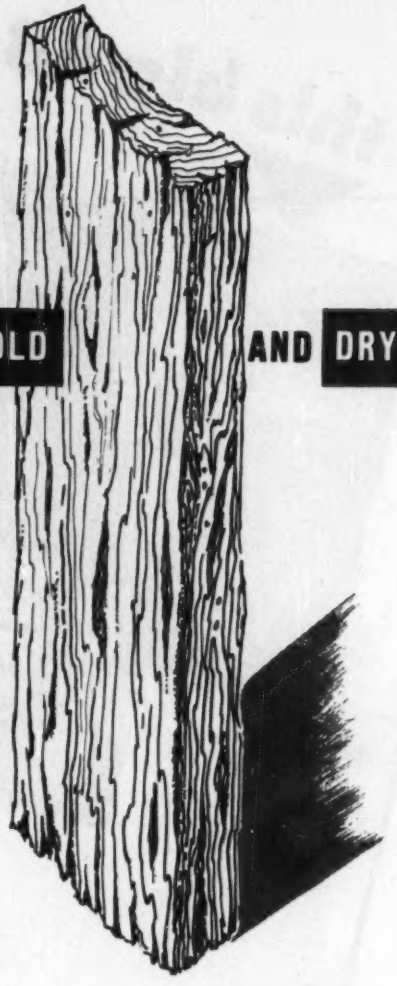
WOOD WON'T ROT WHEN IT'S COLD AND DRY



Living fungi, which break down the substance of wood are microscopic and abundant. But they need a certain amount of WARMTH and DAMPNESS to develop. Dampness will also peel off paint, crumble plaster, rust iron and steel.

Some insulations promote and retain destructive condensation inside walls and other structural spaces. In addition to warmth, vapor of water also flows right through asphalt, paper, plaster and most building materials, including ordinary insulations. It condenses when it strikes a colder surface and reaches a dew-point.

An empty space is the best insulator against heat flow by Conduction; but does not prevent heat flow by Radiation and Convection. Of all heat transferred through structural spaces, 30% to 80% is by Radiation; all but 5% of the rest is Convection. Multiple accordion aluminum sheets throw back all but 3% of the Radiation which strikes them, and block Convection. Their insignificant mass, 1 oz. to the square foot, and their multiple air space construction, minimize Conduction.

They have zero permeability to water vapor and all other gases, including air, hot and cold. Because of their structure, they are non-condensation-forming, for a dew-point can never be reached on any of their surfaces. Neither can they sustain nor retain fortuitous moisture.

Simple and illuminating discussions of vapor and heat flow, including explanations of how to prevent timber rot, will be found in the just-off-the-press, completely revised, 5th edition of "Simplified Physics of Vapor and Thermal Insulation," 56 pages of facts and figures.

The commercial forms of tough, multiple accordion aluminum sheets are Infra Type 6, Type 4, and Type 4 Jr.

INFRA INSULATION, INC.
525 Broadway, New York, N. Y. — WORTH 4-2241

INFRA THERMAL FACTORS. TYPE 6

Up-Heat C.089, R 11.23 = $4\frac{3}{4}$" dry rockwool
Wall-Heat C.073, R 13.69 = $5\frac{3}{4}$" dry rockwool
Down-Heat C.044, R 22.72 = 9" dry rockwool

INFRA INSULATION, INC.
525 Broadway, N.Y., N.Y. Dept (H-12)
Please send FREE "Simplified Physics of Vapor and Thermal Insulation," new 1951 5th edition.

Name_____
Firm_____
Address_____
☐ Send Prices of Infra Insulations ☐ Send Sample

THE EDITOR'S PAGES

• MOTHER NATURE and things mechanical both have ways of taking us down a peg or two every now and then. We've heard some people say that they thought the heavy snows and the large amounts of weather we suffered from last month were due to the test atomic explosions, but we think we know the cause — it was just Mother Nature's way of showing up the refrigeration and air conditioning industry, whose products were on display at the time at Navy Pier, Chicago . . . . . Mechanical devices also play the same sort of dirty trick. On the train recently to attend an out-of-town meeting of heating and ventilating engineers, something went wrong and the heat just couldn't be shut off. Same thing happened in our hotel room the following night. . . . . For years — as part of our editorial duties — we've had to look at the same cartoon suggestion different people send us. It shows ice cubes coming out of the radio, and the refrigerator playing music — all due to some unexplained mistake of the electrician. Now we're afraid we're in for another version of the same sort of thing. Last month, one of the big news magazines bent over backward trying to get a leader in the radio and TV field to predict the "broadcasting" of "electronic air conditioning." We're keeping our fingers crossed, waiting for the first cartoon to be submitted for publication showing Red Skelton popping out of a duct or something. (*Special note. It happened. As we were going to press, the cartoon arrived, and is right on top of the office wastebasket.*)

DIRECTORY SECTION COMING IN JANUARY

A COMPLETE Directory Section of Heating, Piping and Air Conditioning Equipment for Industrial, Commercial, Institutional and Public Buildings — thoroughly revised and brought up-to-date — will appear for the 18th consecutive year in the January HPAC.

Thousands of listing sheets have been mailed to the manufacturers of the hundreds of items of equipment used in heating, piping and air conditioning installations in plants and big buildings for the latest authoritative information on what will be available where during 1952. The information is carefully classified for your use, along with complete street addresses and trade names.

The Directory Section is a plus feature of the January HPAC, which will of course have the regular editorial content (including the Journal Section of the American Society of Heating and Ventilating Engineers.)

IT CAN'T BE POSSIBLE

IT CAN'T BE possible but it is — the end of another year has rolled around. Anyhow, best wishes to you all for a Merry Christmas and a Happy New Year!

INDEX FOR 1951 TO BE AVAILABLE ON REQUEST

AN INDEX for HPAC's 1951 issues, Vol. 23, Nos. 1-12, including the Journal Section of the American Society of Heating and Ventilating Engineers, is being compiled and will be available soon to HPAC's subscribers on request. If you want a free copy, send a note or postcard to the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

We'll keep your request on file until the index has been printed, and will then mail a copy to you.

PREDICTION RE NEXT PRESIDENT OF U.S.

THE NEXT PRESIDENT of the United States will be nominated in air conditioned comfort.

Selection by both the Democratic and Republican parties of Chicago's International Amphitheater as the site for their 1952 national conventions will give the city its first big permanently air conditioned convention hall. Air conditioning of the arena, at a reported cost of some $300,000, is expected to be started soon. A. Epstein & Sons, Inc., are the consulting engineers.

The International Amphitheater was the scene of the Ninth International Heating, Ventilating & Air Conditioning Exposition held in Chicago in January 1949, and the next of these expositions is scheduled at the same place for January 1953.

'52 CONSTRUCTION LIKELY TO DROP 10 PERCENT

CONSTRUCTION'S dollar volume in the 37 eastern states is likely to run 10 percent less in 1952 than in 1951, in the opinion of F. W. Dodge Corp.

The estimate was prepared by Thomas S. Holden, the F. W. Dodge president, jointly with Clyde Shute, assistant vice president and manager of the statistical and research division.

"Construction projects which were refused allotments of critical metals in the fourth quarter of 1951 were deferred, not abandoned," it is pointed out. "Their requirements can be reconsidered and granted in later quarters. Consequently, these projects represent a certain amount of construction demand that will carry over into 1952." The study cites population growth and other expansion factors which cause potential construction demand to accumulate during the current period of metal shortage.

"It seems obvious that the fourth-quarter dip in contract volume will carry over into 1952; it might even continue through the middle of the year," in the opinion of the F. W. Dodge officials. "If the anticipated improvement in the metals situation and consequent easing of controls take place, there should be a definite uptrend of contract volume in the second half of 1952."

Residential building will decline more than any other classification, according to the Dodge outlook, while public works and utilities will decline least. Expected dollar-volume declines percentage-wise are: Nonresidential, 6; residential, 16; and public and private works and utilities, 4; to make an overall decrease of 10 percent. All classifications show expected declines, except privately owned utilities, marked for a 31 percent gain.

While the number of new dwelling unit starts is anticipated to decline 19 percent from 1951, based on the figures of the Bureau of Labor Statistics of the Department of Com-

merce, it is the opinion of the Dodge estimators that next year's total will be 850,000, which until recently was rated as very high volume.

PLAN REVISIONS IN VALVE DIMENSIONS

THE AMERICAN Standards Association committee on pipe flanges and fittings is planning to revise the American Standard Face-to-Face Dimensions of Ferrous Flanged and Welding End Valves, B16.10-1939 R1947, in order to expand the size range of some of the tables with the possibility of adopting the MSS SP-42 dimensions for the smaller size valves, and adopting dimensions which are quite uniformly used by the valve industry for sizes up to 24 in. Consideration is also being given to a table of standard dimensions for the pressure-seal type of valve and a table to cover face-to-face dimensions for single seat pressure reducing valves, the ASA's publication, Standardization, reports.

COMBAT "POST COLLEGE SLUMP"

DEVELOPMENT OF A positive program for combating "post college slump" in engineering was urged by H. P. Hammond, dean emeritus, Pennsylvania State College, to the Engineers' Council for Professional Development annual meeting this fall.

"QUOTE"

"I would like to have you invent an electronic air conditioner that would operate with tubes, or possibly through the action of electrons in solids, and without moving parts. It should be small, noiseless, inexpensive, and should fit into any size room.

"I realize that such a device does not exist at the present time. However, generally speaking, anything that the human mind can conceive can ultimately be produced."—*excerpted from a talk by Brigadier General David Sarnoff, Chairman of the Board, Radio Corp. of America, at ceremonies commemorating his 45 years of service in radio and the naming of the Princeton laboratories of RCA as the David Sarnoff Research Center.*

Dean Hammond elaborated on the "post college slump" as "the period when a college graduate, in his first job, no longer has the compulsion toward mental development because of the difficulty of making adjustments to conditions of employment which do not indicate the need for continuing personal development."

BUILDING CODE SIMPLIFICATION URGED

URGENT NEED FOR standardization and simplification of the country's more than 2000 municipal building codes is cited by the Chamber of Commerce of the United States.

Particularly, said the chamber (in making public a statement by its board of directors), is there necessity for early modernization of codes in view of rearmament demands requiring the most effective use of materials in defense construction. The chamber statement is based on a report by a special committee of experts in the field of construction.

Chambers of commerce and other interested local groups are urged by the national body to take responsibility for obtaining modernization and sound administration of these codes. Uniform state legislation is recommended, requiring communities to keep their codes up-to-date and authorizing less complicated means of adoption by municipal officials of standard codes and requirements. There is no reason, says the chamber, why standards meeting safety and other requirements in one city should not be generally acceptable elsewhere.

"TREMENDOUS BUILDING AFTER EMERGENCY"

A TREMENDOUS resurgence of building after the present emergency was predicted by J. L. Ray, president of the United States Savings and Loan League, speaking recently at the Stanford University business conference. He gave various reasons for this view, including overcrowded conditions in many cities and a national defense policy of decentralization. A substantial majority of this building will be in outlying areas of large metropolitan centers, he explained.

He pointed out that a vast number of new shopping centers will be developed containing everything from huge department stores to financial institutions to serve new residential communities. Many more industrial plants will be constructed in what are now undeveloped areas because of the national defense policy, and also because of accessibility to labor markets.

SEE NATION'S OUTPUT HITTING NEW HIGH

THE NATION'S OUTPUT of goods and services (commonly known as gross national product) will reach a new high in 1952, in the opinion of a substantial majority of 128 economists polled by F. W. Dodge Corp.

A continuous rise throughout 1952 in total output of goods and services is expected by 94 economists, while 34 expect a declining trend during the latter part of next year. The average of all estimates indicates an annual output rate of $334.3 billion in the fourth quarter of this year, and $348.6 billion for the fourth quarter of 1952. The government has estimated that the output for the third quarter of this year was $328 billion.

Other majority views as to 1952 were: Wages, wholesale prices and consumer prices will increase moderately; not on a runaway scale. Industrial production will rise continuously from now until the end of 1952. Construction will decline moderately but still will be of boom proportions. Mortgage money will be plentiful.

AIR CONDITIONER DIDN'T CAUSE FIRE

STORIES IN THE daily press last month attributed a bad fire in a metropolitan drug store to "gas escaping from an air conditioner unit."

In a check of the city fire department and other sources, HPAC was informed that no investigation on the causes of this fire had in any way indicated that the air conditioning installation was at all involved. In fact, the fire attorney seemed quite puzzled that the question had come up, and could think of no source for the reporter's statement.

SUPPORTING A HORIZONTAL TANK

IN THE ARTICLE of the above title on pages 98-99 of the November 1951 HPAC, Equation 2 should read:

$$1.72\ (Rt)^{\frac{1}{2}} \text{ is greater than } 1 \quad ..[2]$$

DONATE A PINT OF BLOOD TODAY!

Dun & Bradstreet Building, 99 Church St., New York City. Architects: Reinhard, Hofmeister & Walquist. Consulting Engineers: Syska & Hennessy. Heating and Air Conditioning Contractors: Kerby Saunders, Inc. General Contractor: George A. Fuller Company.

It's air conditioned It uses STEAM

Uses for Steam in Dun & Bradstreet Building

Steam serves the heat exchanger which heats water as required for the air conditioning system, and circulating hot water for washrooms, kitchen, etc.

Steam, effectively controlled by a Webster Moderator System in two zones, assures comfort heating for the first floor stores.

Steam heats the lobby, stair towers and elevator machinery rooms and protects the roof water tank against freezing.

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"Controlled by the weather"

The new 11-story Dun & Bradstreet Building, with 303,000 sq. ft. of floor area, is the largest office building erected in downtown Manhattan in 20 years.

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As with almost every outstanding Manhattan building, *steam* is the foundation for all the heat requirements . . . *steam*, generated at the waterside and delivered to the building through New York Steam Company's mains. The uses for steam in this air-conditioned building are detailed at left.

Circulation of steam for the Dun & Bradstreet Building is assured by installation of 122 Webster Drip Traps as well as the Webster Moderator System equipment.

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results from (1) Uniform Steam Distribution, and (2) Condensate always exposed to entering Steam

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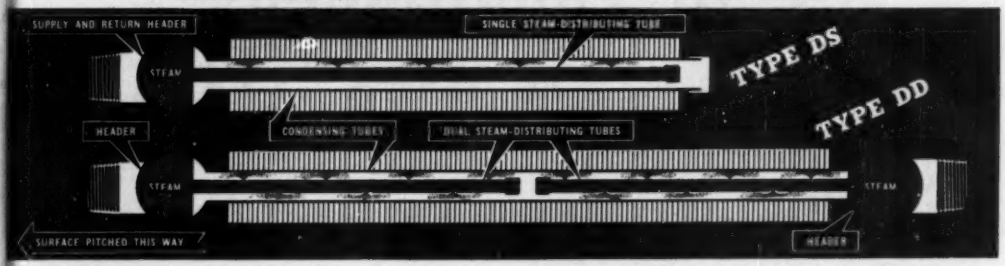

TYPE DS SURFACE: Single supply header; single steam-distributing tube inside each condensing tube, for normal heating and ventilating applications. For installations requiring more uniform discharge temperatures, Type DS Surface with DUAL steam-distributing tubes in finned lengths up to six feet.

TYPE DD SURFACE: Two supply headers (one at each end of the surface section); DUAL steam-distributing tubes inside each condensing tube; steam conducted from the header at each end toward center. Assures uniform discharge temperatures over finned lengths from 78" to ten feet.

How STIFF are the surface requirements in that low-pressure, valve-controlled job of yours? Must you have *strictly uniform discharge temperatures*, regardless of coil length? Then specify Nesbitt Series D Heating Surface with DUAL steam-distribution tubes. Or do you have *less exacting requirements*, but still need acceptable distribution, regardless of coil length? Then specify Nesbitt Series D Heating Surface with SINGLE steam-distributing tubes. All Nesbitt Series D heating coils are *freeze-proof* without the aid of pre-heaters because of the steam-distributing tube feature, developed by Nesbitt. Play safe: say *Nesbitt.*

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OFFICES IN ALL PRINCIPAL CITIES—LIST UPON REQUEST

"Open for Discussion"

• How about expressing your views on one of the articles in this month's issue of HPAC, for publication in these pages? Your comments on a controversial point, or additional information based on your experience, would — we're sure — be interesting and helpful to others. Or perhaps you'd like to say a little on some other matter of importance to plant engineers, building engineers, operating and maintenance men, heating, piping and air conditioning engineers or contractors? We follow here each month the practice at engineering society meetings of providing an "open for discussion" period. You are cordially invited to participate. Address the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

RADIANT CONDITIONING AT "REFLECTION POINT"

In the December 1950 HPAC, Dr. Clarence A. Mills, in his paper *Radiant Conditioning In Use at "Reflection Point"*, wrote: "The only air cooled in summer is that lying in the trough (going around each room up near the ceiling, in the bottom of which are "Freon" coils...)...careful tests never demonstrating any spillage of this chilled air over into the room".

Commenting on the function of the coils in the trough, Samuel R. Lewis wrote, in the May 1951 HPAC: "The refrigerated coil (. . . in the drained gutter near the ceiling. . .) is colder than the dew point, and the moisture condensed out of the air is drained away".

These two views are radically different.

The mechanism of cooling, according to Dr. Mills, takes place by body and other radiant heat reaching the coil by reflection, from the foil covered ceilings and walls.

If no cold air spills over from the trough into the room, convection over the coils will not take place.

If the air remains quietly within the trough, no condensation can occur after the initial deposit of dew on the cold pipes.

Cold pipes under conditions of stagnant air cannot remove any further latent heat as it is produced by body or other sources.

Without latent heat removal, conditions within the room must soon become unbearable.

If this condition does not obtain in practice, then latent heat is certainly being removed either by the condensation mentioned by Mr. Lewis or by the ventilating air admitted from outside. The latter, if naturally dry, may be a powerful remover of latent heat even without artificial cooling.

The term "radiant conditioning" is misleading, it seems to me, since it is not possible to produce conditions of comfort within an occupied room without removal of latent heat.

Radiant cooling itself can never remove latent heat but only sensible heat. This is because moisture laden air does not radiate heat to any extent, but instead requires actual contact by convection against cold surfaces or mixture with dryer air before its absolute humidity or latent heat content may be reduced. Even with chemical drying, direct contact is necessary.

Another point of importance in design is that, with regard to radiant heat transmission, cold pipes and hot pipes do not behave according to the same principles.

A hot pipe radiates heat radially from its axis in all directions. Inversely, a cold pipe in a field permeated by radiant heat, has no effect on the straight line path of that heat.

Radiant heat can only be made to converge into a point or line by means of a parabolic or other reflector.

It should be borne in mind that radiant heat travels in straight lines and is very similar to ordinary light in this respect. Just as ordinary light floods a room, radiant heat spreads out in all directions if not restrained by special reflectors.

Foil covered walls and ceilings will not cause radiant heat to converge on a straight length of pipe by reflection.

Radiant heat leaving the human body does not converge on the cold run of pipe unless the pipe is situated at the focus of a parabolic reflector suitably oriented toward the body.

The use of cold coils within a room should be accompanied by free or forced air circulation over them. Only by this means is moisture removal possible.

Furthermore, reheating of the near-saturated cold convected air leaving the cold coils should be allowed for if proper moisture pickup within the room is to be made possible.

Ordinary air cooling coils, if of sufficient capacity, produce cold air which is about 90 percent saturated and this air, if unreheated, is of little use as a latent heat remover.

For proper application of cold coils within rooms, the use of precooling and reheating coils working on the run-around method are essential and avoid increase in refrigeration load.

The main advantage of using properly installed cold coils within living spaces lies in the elimination of ducts and reduction in fan load.

Proximity of lighting fixtures may contribute to the supply of reheat but at the cost of more refrigeration.

It is doubtful if at the present stage of comfort engineering (as distinct from air conditioning engineering) it is possible to design universally successful installations by employing methods which not only ignore in part the fundamental thermal requirements of the human body but attempt to over-simplify the problems by harnessing radiant cooling to the double job of removing both latent and sensible heat.

In the not too distant future, it seems likely that the task of sensible heat supply or removal will lie definitely with coil embedded floors, walls or ceilings. On the other hand, latent heat will still most likely have to be removed or supplied through contact air convection.

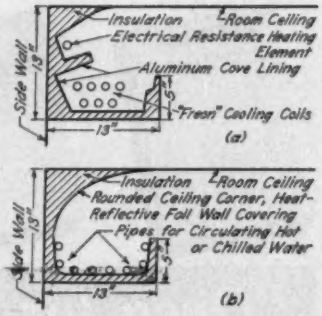
There is a possibility that use of rapid pressure changing devices may enable air to be economically compressed or expanded for moisture expelling or pickup purposes.—Oscar N. Potier, Chartered Electrical Engineer, Lisbon, Portugal.

Comments by Mr. Lewis—Mr. Potier's remarks are thoughtful and constructive, in my opinion.

Dr. Mills wrote in his article that careful tests failed to demonstrate that chilled air ever spilled over the edge of the refrigerated trough along the walls near the ceiling. I did not comment on this statement, but I did write that dew condensed out of the air in the trough was drained away and did not run down the walls to deface them.

Based on Mr. Potier's criticism, I must state now that I should have been a better reporter and should have written "The refrigerated coil (in the drained gutter near the ceiling) would condense on its surface any moisture out of the air, provided that the coil surface is colder than the dew point of the air and provided that air flows over the coil surface." Mr. Potier is right in that if no new air sweeps past the refrigerated surface, no condensation can occur after the initial deposit of dew.

A familiar food store example is the refrigerated cabinet, accessible only through its top, in which frozen viands are maintained indefinitely. The chilled air, heavier than the ambient air, cannot flow up and out of the cabinet. A cold horizontal pipe within a watertight, open-top trough will not particularly encourage air circulation.—Samuel R. Lewis, Consulting Mechanical Engineer. Member of HPAC's Board of Consulting and Contributing Editors.



COVE DESIGN as used at present at "Reflection Point" is shown in the top sketch. New cove design, shown in lower sketch, has pipes for circulating hot or chilled water soldered to blackened metal trough for radiant heat input or removal. Trough is made in sections, with connections for drip pipe and water inlet and outlet. None of the functional workings of the cove is visible to occupants

Comments by Dr. Mills—Mr. Potier overlooks the fact that water vapor may and does travel through air by free diffusion independently of air motion, that condensation can and does take place constantly in my cooling coves even though there be no air currents entering therein. The amount of air moisture thereby removed is continuous and very considerable — although no accurate measurements have yet been recorded. This condensation is not a significant dehumidifying factor, however, in the presence of a constant input of 370 cfm of outside air.

The statement that "moisture laden air requires actual contact by convection against cold surfaces before its absolute humidity or latent heat load may be reduced" is simply not in conformity with the known laws of physics regarding the independent diffusion of gases in mixtures, such as water vapor in air.

Regarding the necessity of parabolic reflectors for efficient radiant heat removal in the cooling coils, we do have essentially such an arrangement in the cooling coves at "Reflection Point."

Radiant heat output from the coves in winter and its removal in summer follow identical pathways (in opposite directions of course). Room occupants, floor coverings, furniture fabrics, etc., are exposed by ceiling reflection to these radiant heating and radiant cooling influences of the heated or cooled cove elements and they exhibit temperatures well above those of adjacent air in winter and well below in summer. It is only in contact with these heated or cooled room surfaces that heating or cooling of the room air takes place.

In actual operation at "Reflection Point," we have sufficient air cooling to maintain an indoor air temperature of 82 F at an outdoor maximum of 95 F — and 86 F indoors even with 103 F outside! This we did with 1.5 tons of refrigeration instead of the calculated Cincinnati design load of 7.3 tons for this house (uninsulated except for ¼ in. of water on its flat roof). This load saving results largely from lack of active air motion within the structure, avoidance especially of cold air currents along warm outer walls, and blockage of radiant heat emission inward from the foil-papered wall surfaces.

Every air conditioning engineer knows that the effect of most of his cooling load input is lost through heat-uptake from the structure itself, that only a minor part of his cooling load is needed for the original cooling of the contained air. For our structure this air cooling amounts roughly to only 8000 Btu per hr out of the 87,500 Btu per hr calculated for conventional air conditioning.

As for Mr. Potier's insistence upon the importance of latent heat removal in summer cooling, I would point out that this is necessary only when the human body must depend to a considerable degree upon sweat evaporation for its heat dissipation. If adequate radiant channels of body heat removal are present, then air humidity becomes relatively unimportant. In fact, we previously reported in HPAC (November 1937) satisfactory bodily comfort from radiational cooling at 95 F air temperatures and over 80 percent relative humidity — conditions under which the human body gains instead of loses heat to its air environment.

The human body has no avenue of choice for dissipation of its waste heat but will use whatever avenues are available. The engineer's problem is thus to provide such adequate cooling at minimal cost (in structure, equipment and operation).—Dr. Clarence A. Mills.

Another Case of COPPER WHERE IT COUNTS

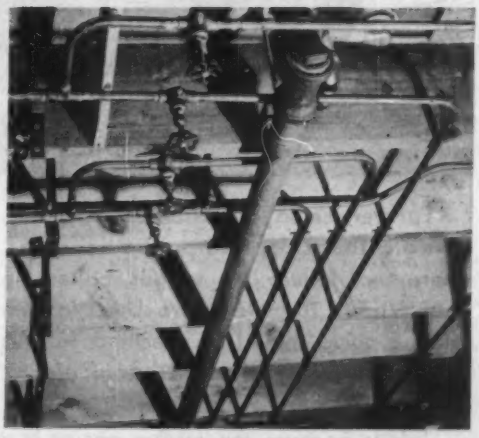
MOHAWK GARDENS, ROME, N. Y.

THE very scarcity of copper has served to point up the many merits of this metal better than anything we might say about it. For, when architects, builders and contractors have tried to find a substitute, they soon discovered many places in building construction where there just isn't any substitute. And they don't hesitate to tell us so.

Two mighty important copper spots are the heating and plumbing lines. That's why Revere Copper Water Tube was used for the entire heating system and for the hot and cold water lines in the plumbing system at Mohawk Gardens . . . the owners were building for permanency.

Although quantities are necessarily limited you can still use Revere Copper Water Tube for domestic hot and cold water lines, underground service lines, industrial processing and for gas equipment.

See your Revere Distributor. He will advise you of the availability of materials and, in the event you wish to discuss your technical problems, put you in touch with Revere's Technical Advisory Service.



NO WIDE OPEN SPACES are needed for wrench swinging when Revere Copper Water Tube is used. It is easily joined with solder or compression fittings, and requires fewer of these fittings because it is easily bent and comes in 60'-length, soft-temper coils. It also is available in hard and soft tempers in straight lengths. Note how neat an installation is made possible with Revere Copper Water Tube, too. Shown is part of the 31,000' of Revere Copper Tube used for heating and the 24,240' used for plumbing in Mohawk Gardens, Rome, N. Y. Architect, Harold G. Rice; Plumbing and Heating Contractor, O'Shea Supply Company; Builder, A. H. Pearsall, Inc. . . . all of Rome, N. Y. Revere Copper also was used to flash the roofs and windows, as well as for the gutters and downspouts.

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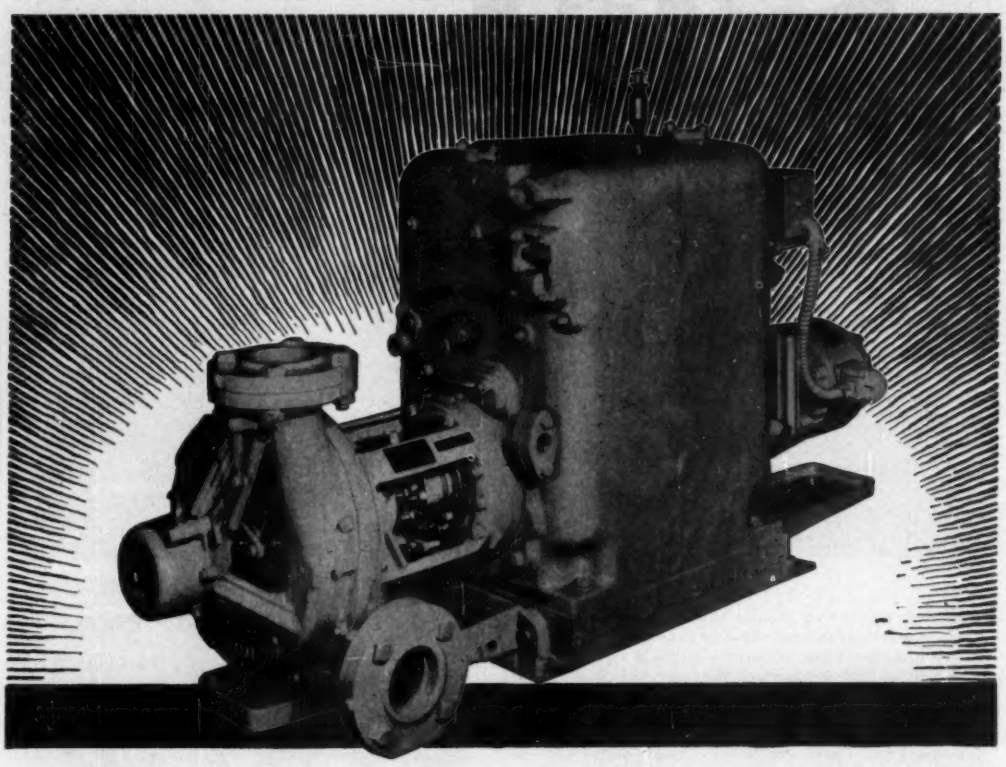
THE NASH VAPOR TURBINE HEATING PUMP IS NOT STOPPED BY ELECTRIC CURRENT FAILURE



For service in greenhouses, hospitals, schools, theatres, and public buildings, where heat failure is a serious matter, the Nash Vapor Turbine Return Line Vacuum Heating pump should be specified, for this pump operates perfectly without electric current.

This is because the motive power is a special turbine operating on steam direct from the heating system. Steam used to drive the Vapor Turbine is returned to the system for heating, with little heat loss.

This pump insures constant heat in the system, it eliminates electric current cost, and it promotes high efficiency in the heating system. Heating efficiency is due to the fact that this pump can operate continuously with economy. Continuous operation means uniform circulation, and uniform conditions in the system mean steam saving.

This pump has but one moving part, no internal wearing parts, and requires no internal lubrication. Bulletin D-246 tells all about it, and it is free on request.

THE NASH ENGINEERING COMPANY

SOUTH NORWALK, CONNECTICUT, U. S. A.

THERE ARE THREE 500 hp oil fired boilers and one 250 hp unit in the NOL steam plant

Preventive Maintenance Road To Low Cost Steam

By M. F. Ridgely, Quarterman Engineer
Chief Engineer of Heating Facilities
Naval Ordnance Laboratory, White Oak, Md.

The Naval Ordnance Laboratory, in White Oak, Md., about 12 miles from downtown Washington, D.C., is the Navy's newest and one of the country's largest and finest ordnance research and development centers. Established in 1946 at its present location, the laboratory's 873 acres and 100-odd buildings house many millions of dollars in equipment, much of which is unique of its kind. The laboratory was originally set up in 1918 to carry on the kind of ordnance experimentation which is so very necessary in keeping the nation prepared, yet which private industry seldom finds economically feasible in peacetime.

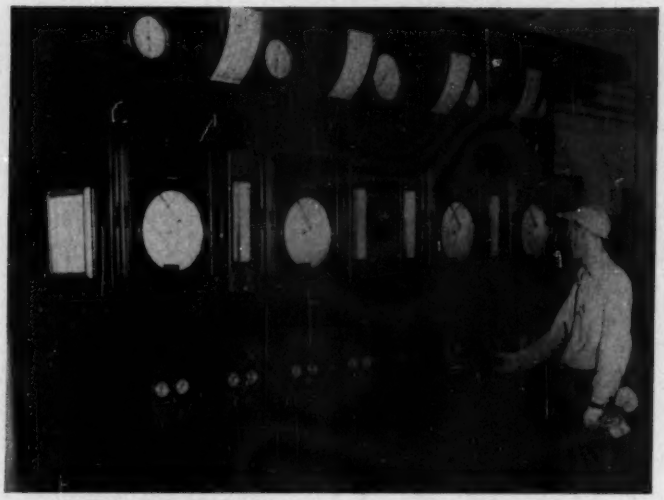
The laboratory is further unique in that its high quality teams of scientists and engineers carry out both pure and applied research in nearly all phases of electronics, acoustics, optics, magnetism and chemistry. Among the unusual facilities at White Oak are the famous supersonic wind tunnels and ballistics ranges, the "anechoic" or echo-free room, and the environmental testing laboratory, where ordnance may be subjected to the kind of pressures, temperatures, and shocks which might be found in field conditions encountered anywhere on the face of the earth.

Well planned maintenance and operation are essential to efficient production of steam for heating and process use. At the Naval Ordnance Laboratory, White Oak, Md. — whose steam plant is little different from those in other large institutional or industrial installations — a preventive maintenance program and on-the-job training of operating personnel assure reliable and economical results

AN ESTABLISHMENT of the size and nature of the Naval Ordnance Laboratory at White Oak, Md., is one which understandably demands a constant, adequate and dependable supply of steam. The uses to which this steam is put consist mainly of heating the rather large, diversified and spread-out buildings of the laboratory, and of processing — primarily in the specialized plastics laboratory, where large quantities of steam are needed for compression, injection, transfer molding and in the curing of various plastic materials.

The major part — about 75 percent — of the steam required by the Naval Ordnance Laboratory is produced in its main boiler plant and distributed through an extensive network of tunnels and trenches. There is also a 10 in. high pressure main steam line running overland almost three-quarters of a mile from the main boiler plant to the wind tunnel laboratory. In addition to the main plant, there are 30 smaller boiler plants scattered around the laboratory in order to supply some of the more remote building-groups with steam for heating and laboratory processing.

The installation in NOL's main steam plant consists of four high pressure oil fired boilers, with a total combined output of 1750 hp. Three of the boilers are rated at 500 hp each, and the fourth at 250 hp, and they supply steam to the mains at a



CONTINUAL OBSERVATION of the boiler controls is essential to efficient combustion

pressure of 125 psi. This plant also houses the equipment needed to perform most of the maintenance operations on the boilers and equipment, along with water analysis and treating facilities. In addition, provision for emergency electrical power supply has been made by the installation of a 50 kw, 440 volt, three phase a-c diesel-electric generator, which supplies not only the steam plant but also the NOL fire department and garage.

Additional portable units are also available for immediate use anywhere on the station.

Planned Operation Assures Good Service

Such, in general, are the main steam production facilities. The laboratory itself is a highly specialized place, with equipment — including that in its boiler plant — of the best. But in the demands placed on its steam plant, and in the standards of operation it is required to meet, NOL's boiler plant is very little different from those in other large institutional or industrial installations. The top management of the laboratory is interested (as in any other organization) in producing steam and power at a minimum cost. It is also concerned with securing the longest possible service from the available equipment. We feel that the best way to achieve these ends lies in a continuously functioning program which combines sound, efficient operational practices with well planned preventive maintenance.

Volumes have been written on the subject of boiler plant inspection and maintenance, and every engineer who can stand a watch probably feels that he, too, could write a book on this subject. The ASME boiler code contains a wealth of information to guide engineers in the care of boilers and equipment. Occasionally, the substitution of certain short-cuts designed to prolong boiler life without a complete maintenance program are suggested. However, if the long-range program provided by the ASME code is adhered to, it is our belief that better results will be achieved. In addition, it is essential that each individual concerned with carrying out this program be trained and made to realize that he has a highly important and responsible duty to perform, since these high requirements are often undervalued by those who have not been made fully aware of their significance.

Capable Personnel Essential

Successful operation of modern boiler plants depends upon capable personnel whose experience has given them considerable versatility with steam generating equipment. Modern steam plants are provided with warning devices and alarm systems for alerting the operating engineers to trouble, but no alarm system can provide the instinctive anticipation of emergencies as well as can a trained engineer who is at all times on the job.

To insure proper firing, efficiency record logs of hourly readings must be maintained; flow meters, CO_2 recorders and draft gages must be observed continuously in order to maintain uniform firing rates and constant pressures. These record logs should be checked and studied daily by the supervisor for possible ways to improve conditions or lower costs. In the NOL boiler plant, a monthly utilities report is prepared and posted which arouses a competitive spirit between the different shifts. This report includes three essential items: (1) the cost of producing 1000 lb of steam; (2) the evaporation per pound of fuel; and (3) the percentage of feedwater make-up.

In order to assure maximum efficiency and longer boiler life, special care must be given to the make-up water. Hard water must be treated by a softener to eliminate the calcium and magnesium before it enters the preheater. Daily chemical analysis of the water by an engineer determines the amount of chemical (phosphate and tannin) to be induced into the boiler and serves as a guide for blowdowns. By giving close attention to water treatment, boiler surfaces are protected from damage by corrosion and scale.

A further treatment of boiler water surfaces, which has been included in the NOL boiler plant maintenance schedule, is the use of a high temperature water and steam resistant paint. The water sides of the tubes, drums and header are thoroughly cleaned of all foreign matter and the protective paint is "brush applied" to the surfaces. The paint is not affected by our chemical feedwater treatment nor does it retard heat transfer while steaming. The coating (two layers) is approximately 0.0025 in. thick. It is also used as a protector in our hot water domestic heaters, the return pump receivers and our deaerating tank.

Prearranged and carefully scheduled preventive maintenance of boilers and the auxiliary equipment — turbines, oil heaters, pumping units, deaerating tanks, etc. — is necessary for long equipment life and low operating costs. Paying close attention to the condition of expansion joints, traps, reducing valves and drain line leaks will do a great deal to reduce

waste of much valuable heat. Leaks in boiler settings must be carefully watched lest they become a menace to plant costs. A little oil in the right places will both reduce operating expense and lengthen the effective life of auxiliary machinery.

Schedule for Boiler Overhaul

Special plans should be made in advance for overhauling a boiler just taken off the line. All the necessary repair parts and materials should be readily available when the boiler is opened. A complete inspection is then made of the unit, and an overhauling program laid down (with specific plans being arranged to suit the conditions). To expedite a job of this type, the prearranged plans must be followed closely.

It may be of interest to outline the overhaul plans, which provide the operating procedure in the NOL steam plant:

1) All boiler water surfaces, including internal ones and water headers, should be washed, cleaned, brushed, turbined and painted (as required).

2) Fire sides — which include furnace walls, passes, baffles, tubes and breeching — should be thoroughly cleaned. Repair or replace as required brickwork, boiler setting and insulation.

3) All operating valves, such as turbine throttle valves, feedwater valves, non-return valves, main stop valves, and safety valves, should be tested, checked, repacked, repaired or replaced as may be required.

4) Dampers and air registers should be cleaned and adjusted to insure proper operating conditions.

5) Turbines are dismantled, and all bearings, blades and working parts are examined for defects and replaced if warranted.

6) The water column, feedwater regulators and injectors are cleaned, repaired and tested.

7) All automatic controls are cleaned, checked, recalibrated and all necessary replacements made.

IN A WAY, THE BOILERS "drink" better water than do the engineers. Testing water samples is part of the daily routine

FRONT COVER PHOTO — A burner is inserted by Fireman John Farr, while Mr. Ridgely looks on. A recent letter of commendation from Rear Admiral W. G. Schindler, White Oak commander, referred to the "excellent condition" of the boilers and boiler room and said that the annual inspection reflected most favorably on the operating staff.

After every item on the boiler and the equipment associated with it has been overhauled and inspected, the boiler is subjected to a hydrostatic test of 1½ times the design pressure. The unit is then fired up, the safeties popped and a final inspection made. Providing the overhaul job has been properly performed and the final test measures up to required specifications, a period of long, troublefree operation can be anticipated.

Preventive Maintenance Is Good Insurance

Preventive maintenance is, after all, merely a method of foreseeing trouble and stopping it before it starts. It's a kind of insurance, where you pay out a little money regularly in order to avert a breakdown which could be far more costly, not only in equipment but also in the lives and health of the men working around it. Well maintained equipment is safe equipment.

The preventive maintenance and overhauling policy for our generating units and the auxiliary equipment as it has been outlined above has

THE PLANT IS EQUIPPED to perform most of its own periodic maintenance operation. An 8 in. gate valve disc is being refaced. The plant is prepared to reface any gate valve from 2 to 16 in.

TUBES ARE BLOWN each watch to maintain clean heating surfaces. A fireman operates the steam soot blowers on one of the boilers

earned for us an excellent boiler report plus a commendation.

Management may in some cases frown on the policy of preventive maintenance, with the idea in mind that it would result in higher operating costs. However, this is decidedly untrue in the long run. If concentrated attention is given the upkeep and repair of the plant and its equipment, rarely will major breakdowns and costly repairs occur during the heating season. Breakdowns — when they do occur because the proper precautionary measures have not been taken — are usually of a magnitude that far surpasses the small cost of preventive maintenance.

On-the-Job Training Aids Results

Over and above the equipment itself, there is yet another factor to the preventive maintenance program carried on in the NOL boiler plant. This is an efficient on-the-job training program, which we feel to be absolutely essential for any large, well-run steam plant. Men must be trained for routine shift operation and for any conceivable emergency which may occur. This training includes the corrective action to be taken in cases of low water in the boiler, a ruptured tube, the procedure for restoring power, and the proper method for operation of emergency power units. Out of discussions which are a part of these training programs come the ideas, problems and solutions which are invaluable to any operating plant. Every effort has been made to eliminate taking chances by instructing personnel in our safety program, and all personnel are required to complete the Red Cross standard first aid course.

Cleanliness is essential in the operation of any boiler plant. Each shift is assigned a definite area, and the watch engineer is held personally responsible for the proper upkeep and cleanliness of the area involved. This promotes a spirit of competition between the various shifts, which in turn has a tendency to promote shop morale, improve housekeeping and to lower operating costs.

Our record of six years of continuous service with no breakdowns and no lost-time accidents indicates that the execution of an adequate operating and preventive maintenance program as well as an on-the-job training and safety program is essential to the efficient operation of a boiler plant such as ours.

PIPING MATERIALS FOR PROCESS USE

THERE IS mentioned in the article by Carl B. McLaughlin in the October HPAC, on *Piping Materials for Chemical Processes,* a report that stainless steel equipment produced clouds in whiskey. We question this statement, and would suggest that this point be checked. It is our understanding that quite a bit of stainless steel is being used in the production of all types of alcoholic beverages, including whiskey. As far as beer and wines are concerned, the material is ideal; and the writer has been told that a winery is no longer modern unless it has stainless steel equipment. Furthermore, it is our understanding that whiskey derives its color from the wooden barrels in which it is stored, and that raw whiskey is colorless. We believe that such a statement concerning the suitability of stainless steel is out of order. Published corrosion data issued by the stainless steel producers rate stainless steel as being fully resistant to whiskey. I would like to know where this statement originated and the grade of stainless steel used, as I would like to investigate the matter.

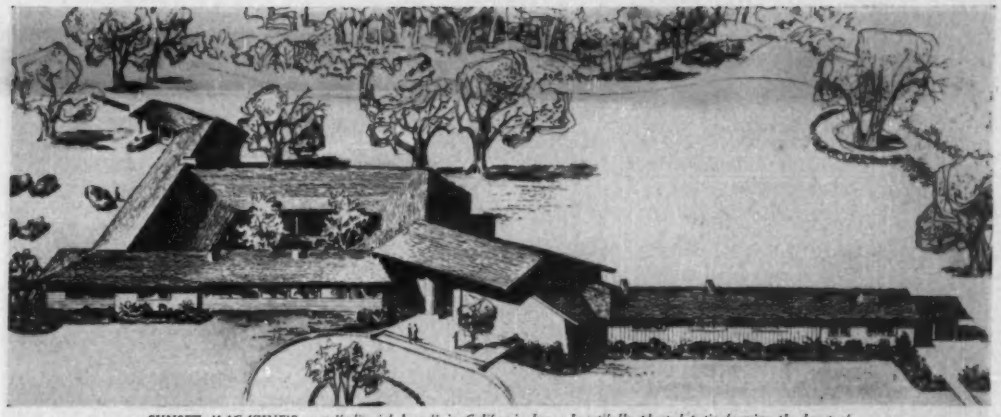
The article mentions that for very low temperatures only aluminum, nickel, copper, and stainless steel alloys can be used satisfactorily, but that economics continue to draw attention to copper and aluminum. We would not rate stainless steel in the same class as most of these other materials, as we believe that stainless steel is second to none. Our laboratories have done a great amount of work with chromium-nickel austenitic stainless steel at temperatures down to that of liquid air, and the material does not suffer loss of strength or toughness at these extremely low temperatures. The very low temperature equipment used by our corporation is made of austenitic chromium-nickel stainless steel and has given excellent service.

The article infers that it is important to keep in mind the susceptibility of types 304, 347 and 316 stainless steel to carbide precipitation. This gives the reader the wrong impression as type 347 is *not* susceptible to carbide precipitation.

We have always considered tantalum as being a residual element in ferrocolumbium, rather than an impurity. The article states that the ferrocolumbium alloy is now becoming scarce, forcing the use of ferrotantalum-columbium. This is misleading, as production of the latter has replaced much of the production of ferrocolumbium in order to utilize leaner ores.

A statement is made that up to the present time revised specifications for 18-8 columbium tantalum do not permit the use of this alloy in welding rods. Any such specifications which may have existed have now been changed, with the result that practically all stabilized welding rods are now made with the columbium-tantalum composition.

The October HPAC is a very handsome job and I was particularly interested in reviewing this article. I hope that my additional comments about stainless steel will be of value to HPAC's readers.—H. L. PRIESTLEY, Electro Metallurgical Co., Div. of Union Carbide and Carbon Corp.



SUNSET MAGAZINE'S new "editorial home" in California has a beautifully planted patio forming the heart of the quadrangle in the editorial wing on the left, where staff members gather morning and afternoon for coffee

New "Dream Home" for West's Sunset Magazine

Hacienda-Like Headquarters for "The Magazine of Western Living" Has Floor Heating System, Tempered Air for Offices

LANE PUBLISHING CO., whose Sunset magazine is a leading exponent of the "indoor-outdoor" living theme typified by the western ranch house style of construction, has moved into a new $500,000 hacienda-like "editorial home" at Menlo Park, 30 miles south of San Francisco, which is heated with a combination of floor radiant heat and tempered air.

Here, a staff of 100 produces not only the magazine but the equally popular Sunset books, in a home and garden setting that spreads across 30,000 sq ft of a seven acre site.

Higgins & Root, the architects, and Cliff May, creator of ranch-style homes for "modern living," designed the low, single story building to capture the mood and atmosphere of Old California.

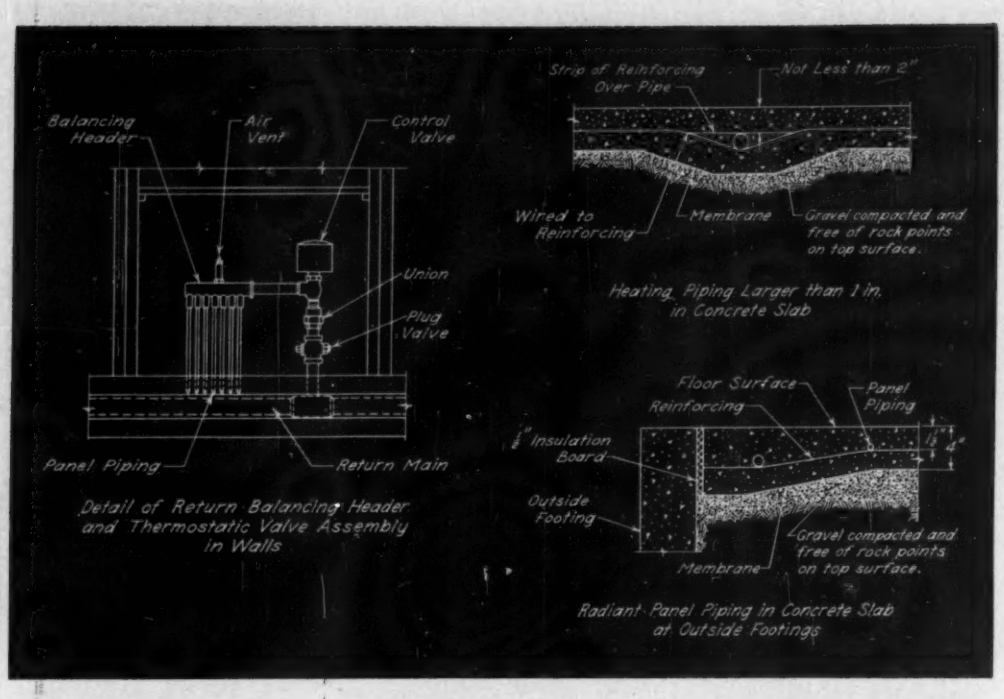
In reality, the building is the "dream home" of Publisher L. W. Lane. During his 23 years of ownership of "the magazine of western living," he has planned for the day when he could remove his staff from metropolitan living and working pressures and produce his magazine and books in suburban surroundings most closely related to his sharply defined editorial interests—the "how-to-do-it" of western home building, food preparation, gardening, recreation and travel. He wanted in the new building generous use of native materials — adobe walls, overhead exposed wooden beams, re-sawed redwood paneling, hand wrought iron fixtures — blended with such modern facilities as picture windows, radiant heating, indirect lighting, acoustical ceilings, sliding steel sash, etc.

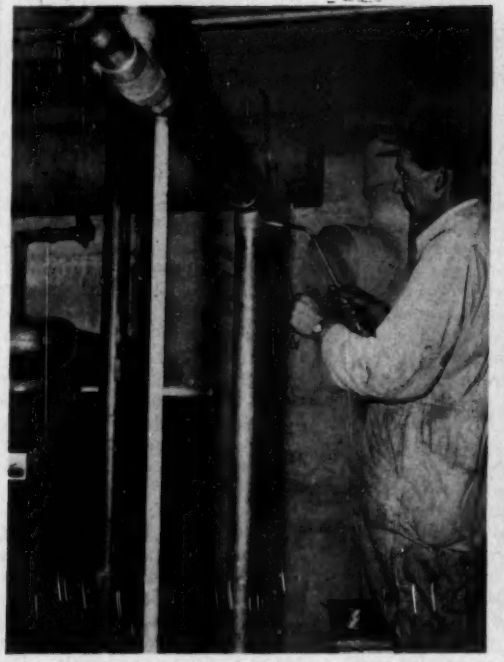
An unusual and potentially useful feature is two 6 x 6 ft soundproof "don't-bother-me" rooms for undisturbed editorial thought.

"Sunset's home must be a place where workers confined to four walls can still have the feeling of outdoor living," Mr. Lane emphasized to the building's designers. He also wanted "complete comfort in all seasons."

The "complete comfort" includes a radiant heating system installed in a 4 in. concrete slab, upon which the entire structure is built. The system serves the building's two wings, including the open air barbecue and serving area and the 44 x 56 ft reception lobby with its 20 ft high beamed ceiling.

Heating presented a special problem in the lobby, because two 10 ft high hand-carved front doors and a sliding glass door leading to the rear gardens allow outside air to enter the high-ceilinged area. Too high a temperature in the radiant floor heating system would be undesirable. The solution, as worked out by the consulting engineer, Charles Drace, and





THE NEW BUILDING IS HEATED by a radiant heat system. At left, a pipefitter silver solders a copper pipe joint with an acetylene torch. . . . **THE COPPER TUBE** is on top of the concrete slab (right) and is covered with 12 in. squares of hand-made desert tiles in hallways, reception lobby and the barbecue area

the architects, was found in the addition of an electric radiant wall heater behind a grille in the 2 ft adobe wall.

In hallways, reception lobby and the outdoor barbecue area, the copper tube of the radiant heating system is laid on top of the concrete slab, with a covering of 12 in. squares of hand-made desert tiles. Elsewhere, it is installed in the slab itself.

A total of 31,000 ft of tube is used in the system, plus 2000 ft of return piping to the gas fired hot water boiler which is located in a small basement room under a portion of the lobby. The hot water is circulated by a 3 in. pump with a 30 ft head, moving 95 to 100 gpm.

The tempered air in the offices is introduced through ceiling ducts. The air is warmed by a floor mounted, recessed unit heater supplied with water from the same boiler serving the floor heating system.

Temperature control of the radiant system is provided through 18 stations located in the various sections of the building. Control is based upon a winter minimum temperature of 30 F for an interior temperature of 68 F.

The building is insulated with 15 in. x 48 in. batts of mineral wool stapled to 2 in. x 6 in. ceiling joists, and between wall studs. Where open beam ceilings occur, insulation is achieved by a 1 in. layer of fiber glass over the roof sheathing. Roofing is of hand-split redwood shakes, which average 1½ in. in thickness. Except in the sections in which adobe bricks form the walls, front walls are of redwood siding. Side and rear walls are plaster covered.

The warehouse and garage have bare whitewashed beams and roof boards. The garage is unheated, while the warehouse is heated with an overhead gas fired unit heater.

Schlegel Plumbing Contractors, Palo Alto, installed the heating and plumbing systems. The general contractor was Howard J. White, Inc., Palo Alto.

On the first two of the four open-house days, more than 3000 advertisers, advertising agency representatives, publishers and business executives from various California cities were conducted on a tour of the plant. On the following two days, the building was open for public inspection.

MAN-MADE CLIMATE AS AN ART

THE FOLLOWING paragraphs are excerpted by permission from an article entitled *The Crystal Ball*, published in The Magazine of Building, in which "the professor" addresses a group of young architects:

"You have all of you heard a great deal about such things as 'thermal comfort'—have any of you ever imagined such a thing as a 'thermal banquet'?

"I thought not. But I have been thinking about it privately for quite a while. And it can be explained—quite rationally, too!

"If you really needed proof on how very little the idea of architecture as an art has penetrated into the modern 20th century world, all you need to do is listen to the art architects talk about the mechanical engineers. Such scorn!

"To such art architects, bent on creating beautiful structures enclosing wonderful space, the very idea of heating engineers or other mechanical engineers, with their pipes, ducts, and statistical tables, is abhorrent. These art architects prepare a feast for the eye and through the eye for the heart and mind, the way traditional architects did who built the cathedrals. All else is secondary and unimportant to them—it's not 'art.'

"Yet the sciences of heating and lighting and acoustics and all the other technologies that add up to a 'man-made climate' within buildings are a grand new achievement of the 20th century, needing only *imagination* to convert them into genuine art.

"The fact is that a man who walks into a building is not just a disembodied pair of eyes. He brings his lungs with him and his pores and his ears and nose; and every one of these senses keeps reporting to him 'this is—or is not—a good place.'

"The only part of this total environment of which architects have yet made an art is the flow of light through it—because that is visual, and for thousands of years architects have been mistaught that architecture is just one of the 'visual' arts. What rot! It's visual, social, and environmental.

"Soon architects will be working with the mechanical engineer just as freely as they work now with the creative lighting engineer, and for the same purpose. In lighting, the day is past when 'comfort' conditions are enough—the creative young architects and engineers are working on past it toward pleasure and joy. Soon the same kind of feast will be prepared for the pores. It will be not just 'thermal comfort', but a thermal banquet."

PARACHUTES DELIVER HEATING UNITS

WHEN THE Danish government decided that pot-bellied stoves were far too dangerous for their Greenland weather observation station, oil fired unit heaters were ordered to do the job, according to the Prat-Daniel Corp.

Delivery became an immediate problem since there are no rail lines to Greenland — and no truck routes. There is no airport convenient to the weather station, and the supply ship makes only annual visits.

Since the equipment was needed for this winter's heating job, parachute delivery was the only possibility. An 1800 lb unit was packed in a special shock-resisting case. It was attached to a king-sized parachute and dropped from a plane flying over the station. The heater floated gently down to the ice without damage. It was uncrated and in operation within a few hours. The success of the "parachute delivery system" led to orders for five more units.

COURTHOUSE STEPS ENGINEERED FOR SAFETY

SOMETHING NEW in safety has been engineered into a new addition to the Anne Arundel county courthouse at Annapolis, Md. In order to keep the approach to the main entrance clear of snow and ice all winter long, a snow melting system has been installed beneath the steps.

Each marble tread has a run of wrought iron pipe beneath it, through which is circulated a heated water-antifreeze solution. Two additional runs of pipe in the sidewalk will take care of any runoff.

Another advantage of this system of snow removal is that it avoids injury to the marble steps that might be caused by snow shovels or chemicals.

Power Plant Piping

By Hugh Welshman, Jr.
Manager, Industrial Piping Div.
Grinnell Co., Inc.

Careful consideration should be given the design, manufacture, fabrication, installation and operation of modern piping systems. Present piping developments add to the necessity for proper engineering interpretation, specialized facilities, rigid inspection and control, and skilled shop and field supervision

THE INCREASING importance of piping systems in modern steam power plants justifies the same careful consideration of their design, manufacture, fabrication, installation and operation as is given the other mechanical equipment — the turbines, boilers, pumps, heaters, etc.

The merit of a well-designed piping system can be judged on the basic principles of mechanical design, such as (1) selection of pipe size to allow reasonable velocities and friction losses; (2) strength of parts to provide flexibility within allowable stress limits; (3) selection of materials to provide stability under service temperatures and pressures for the life of the plant; and (4) selection of hangers and supports to prevent additive stresses and the shifting of pipe weight loads to connecting equipment.

Present developments in the design and selection of materials for steam power plant piping systems add to the necessity for proper engineering interpretation, specialized facilities, rigid inspection and control, and skilled supervision in the shop and field.

Codes for various piping services have been developed by nationally recognized bodies. The sound engineering practices incorporated in these codes indicate the minimum safety requirements for selection of materials, dimensions, design, erection and testing of piping systems. By means of interpretation and revision, these codes continually reflect the knowledge gained through the research and experience of the entire industry.

Code Requirements for Piping

Generally, piping codes form the basis for state or municipal safety laws. Compliance with a code which has attained this status is mandatory for all systems included within its jurisdiction. Although most of today's piping installations are not within the scope of any mandatory code, it is advisable to comply with the applicable code in the interests of safety and as a basis for contract negotiations. Contracts with various agencies of the federal government are regulated by federal specifications or rules which have no direct connection with the codes enumerated below.

The ASME Boiler Construction Code is mandatory in many cities and states in the United States and Canada. Local application of this code into law is not uniform, making it necessary to investigate the city or state laws which have jurisdiction over the installation in question. Compliance with it is required to qualify for insurance approval.

The American Standard Code for Pressure Piping (ASA B31.1) is, at present, a non-mandatory code. However, several legislative bodies are presently considering the adoption of this code. The minimum safety requirements of this code have been accepted by the industry as a standard for all piping outside the jurisdiction of other codes.

These codes are not to be considered as design standards. The designer has complete freedom to design in excess of these requirements.

Determination of Pipe Sizes

Before proceeding with a drafting layout of a piping installation it is necessary to determine pipe sizes which allow reasonable velocities and friction losses. For economical considerations, it is desirable to maintain

TABLE 1—CONVERSION FACTORS for flow of steam as given in Fig. 1

½ to 100 psi

Press. Lb Gage	Temp. at Saturation	Total Temperatures—Degrees F															
		Sat. Temp.	300°	350°	400°	450°	500°	550°	600°	650°	700°	750°	800°	850°	900°	950°	1000°
½	213.7°	1.00	.942	.912	.885	.860	.837	.817	.797	.779	.762	.746	.731	.718	.704	.692	.679
5	227.1°	1.130	1.075	1.042	1.011	.982	.956	.932	.911	.889	.869	.851	.834	.818	.803	.789	.775
10	239.4°	1.256	1.205	1.167	1.132	1.101	1.072	1.045	1.020	.997	.975	.955	.936	.919	.902	.885	.871
15	249.8°	1.369	1.323	1.282	1.244	1.209	1.176	1.148	1.120	1.095	1.071	1.048	1.027	1.008	.989	.972	.954
20	258.8°	1.473	1.425	1.378	1.336	1.298	1.261	1.229	1.200	1.171	1.144	1.120	1.097	1.076	1.056	1.036	1.019
25	266.8°	1.568	1.529	1.477	1.430	1.398	1.351	1.315	1.282	1.254	1.224	1.198	1.178	1.150	1.128	1.109	1.090
30	274.0°	1.658	1.615	1.558	1.508	1.463	1.424	1.385	1.354	1.323	1.293	1.266	1.241	1.215	1.194	1.171	1.151
35	280.6°	1.742	1.714	1.656	1.603	1.557	1.514	1.475	1.438	1.403	1.371	1.343	1.315	1.289	1.264	1.242	1.220
40	286.7°	1.823	1.797	1.735	1.680	1.629	1.583	1.541	1.503	1.467	1.434	1.403	1.378	1.348	1.323	1.299	1.276
45	292.4°	1.900	1.887	1.821	1.763	1.711	1.662	1.618	1.577	1.540	1.505	1.473	1.441	1.414	1.386	1.363	1.339
50	297.7°	1.972	1.971	1.900	1.836	1.778	1.727	1.680	1.635	1.594	1.558	1.525	1.494	1.465	1.440	1.414	1.390
60	307.3°	2.111	....	2.036	1.970	1.910	1.857	1.807	1.762	1.720	1.681	1.646	1.614	1.582	1.553	1.525	1.499
70	316.0°	2.239	....	2.175	2.105	2.035	1.978	1.925	1.879	1.832	1.792	1.752	1.717	1.683	1.651	1.621	1.593
80	323.9°	2.361	....	2.310	2.230	2.162	2.100	2.040	1.990	1.940	1.897	1.858	1.818	1.780	1.748	1.716	1.685
90	331.2°	2.477	....	2.435	2.353	2.280	2.212	2.150	2.093	2.041	1.996	1.952	1.911	1.874	1.838	1.805	1.774
100	337.9°	2.586	....	2.555	2.469	2.392	2.322	2.258	2.198	2.143	2.091	2.042	2.001	1.960	1.925	1.890	1.859

125 to 700 psi

Press. Lb Gage	Temp. at Saturation	Total Temperatures—Degrees F													
		Sat. Temp.	400°	450°	500°	550°	600°	650°	700°	750°	800°	850°	900°	950°	1000°
125	352.8°	2.842	2.710	2.633	2.565	2.495	2.435	2.370	2.312	2.266	2.220	2.174	2.132	2.092	2.052
150	365.9°	3.073	2.986	2.884	2.790	2.710	2.642	2.572	2.512	2.458	2.404	2.354	2.312	2.271	2.230
175	377.4°	3.288	3.225	3.110	3.010	2.920	2.842	2.770	2.702	2.642	2.583	2.530	2.485	2.438	2.395
200	387.8°	3.490	3.450	3.330	3.215	3.115	3.025	2.950	2.882	2.807	2.746	2.690	2.642	2.594	2.548
225	397.3°	3.682	3.675	3.530	3.410	3.300	3.206	3.120	3.045	2.978	2.913	2.856	2.799	2.747	2.697
250	406.0°	3.865	....	3.720	3.595	3.484	3.385	3.288	3.205	3.135	3.065	3.002	2.942	2.886	2.835
275	414.1°	4.037	....	3.908	3.780	3.650	3.540	3.440	3.360	3.280	3.210	3.140	3.080	3.020	2.970
300	421.7°	4.200	....	4.100	3.950	3.820	3.710	3.600	3.510	3.430	3.350	3.280	3.220	3.150	3.100
350	435.6°	4.520	....	4.460	4.290	4.140	4.000	3.890	3.790	3.690	3.600	3.530	3.460	3.400	3.340
400	448.1°	4.820	....	4.810	4.580	4.400	4.270	4.150	4.050	3.950	3.860	3.770	3.690	3.620	3.560
450	459.5°	5.110	....	....	4.910	4.710	4.550	4.410	4.300	4.190	4.100	4.010	3.920	3.840	3.780
500	470.0°	5.380	....	....	5.210	4.990	4.820	4.670	4.540	4.430	4.320	4.230	4.140	4.060	3.980
550	479.8°	5.650	....	....	5.510	5.260	5.050	4.910	4.770	4.650	4.530	4.440	4.340	4.260	4.180
600	488.8°	5.900	....	....	5.820	5.530	5.310	5.150	5.000	4.860	4.750	4.640	4.540	4.450	4.370
650	497.3°	6.150	....	....	6.120	5.790	5.560	5.380	5.220	5.070	4.950	4.840	4.730	4.640	4.550
700	505.4°	6.380	....	....	....	6.060	5.820	5.620	5.450	5.310	5.170	5.040	4.920	4.820	4.720

750 to 1500 psi

Press. Lb Gage	Temp. at Saturation	Total Temperatures—Degrees F										
		Sat. Temp.	550°	600°	650°	700°	750°	800°	850°	900°	950°	1000°
750	513.0°	6.62	6.33	6.09	5.87	5.69	5.52	5.37	5.23	5.11	5.00	4.89
800	520.3°	6.85	6.59	6.33	6.09	5.88	5.70	5.55	5.41	5.28	5.16	5.05
850	527.2°	7.08	6.86	6.55	6.29	6.07	5.89	5.72	5.57	5.44	5.32	5.22
900	533.9°	7.30	7.13	6.79	6.53	6.30	6.10	5.91	5.75	5.61	5.49	5.37
950	540.2°	7.52	7.40	7.03	6.73	6.48	6.28	6.10	5.93	5.78	5.65	5.53
1000	546.3°	7.73	...	7.20	6.87	6.61	6.40	6.22	6.07	5.93	5.79	5.67
1050	552.2°	7.95	...	7.43	7.08	6.81	6.58	6.38	6.23	6.09	5.95	5.82
1100	557.9°	8.16	...	7.66	7.27	6.96	6.73	6.55	6.39	6.24	6.10	5.96
1150	563.4°	8.37	...	7.90	7.50	7.16	6.91	6.71	6.53	6.38	6.23	6.11
1200	568.6°	8.58	...	8.15	7.66	7.30	7.08	6.87	6.69	6.53	6.38	6.25
1250	573.8°	8.79	...	8.39	7.88	7.54	7.25	7.03	6.83	6.66	6.51	6.38
1300	578.7°	8.99	...	8.65	8.15	7.73	7.44	7.19	6.99	6.82	6.65	6.52
1350	583.6°	9.19	...	8.90	8.25	7.84	7.56	7.34	7.15	6.97	6.80	6.65
1400	588.3°	9.40	...	9.17	8.44	8.04	7.73	7.50	7.28	7.11	6.94	6.79
1450	592.9°	9.60	...	9.45	8.67	8.21	7.91	7.65	7.44	7.24	7.07	6.91
1500	597.4°	9.80	...	9.75	8.94	8.41	8.07	7.80	7.58	7.39	7.21	7.04

The chart shown in Fig. 1 is based on ½ lb gage pressure saturated steam. At increased pressures and temperatures, steam pipe will carry load as indicated in chart times (X) conversion factor above, with pressure drop as indicated in chart. To simplify the use of the chart it is suggested that the steam loads in question be corrected by dividing them by the proper factor above. Then apply corrected load directly to the low pressure chart.

the velocity as high as possible without causing excessive operating losses as a result of excessive pressure drops.

Reasonable velocities for water and steam are indicated by the following ranges:

Service water mains	2 to 5 fps
General service water piping	4 to 10 fps
Boiler feedwater piping	6 to 15 fps
Low pressure steam heating and process piping	15 to 70 fps
Low pressure steam mains	70 to 165 fps
High pressure steam mains	165 to 400 fps
Steam engine and pump piping	100 to 150 fps
Steam turbine piping	150 to 330 fps

The friction of fluid flowing in a pipe line causes a drop in the initial pressure, which drop is approximately proportional to the square of the velocity, and directly proportional to the effective length of the line.

Effective length of a pipe line is the sum of the total length of the

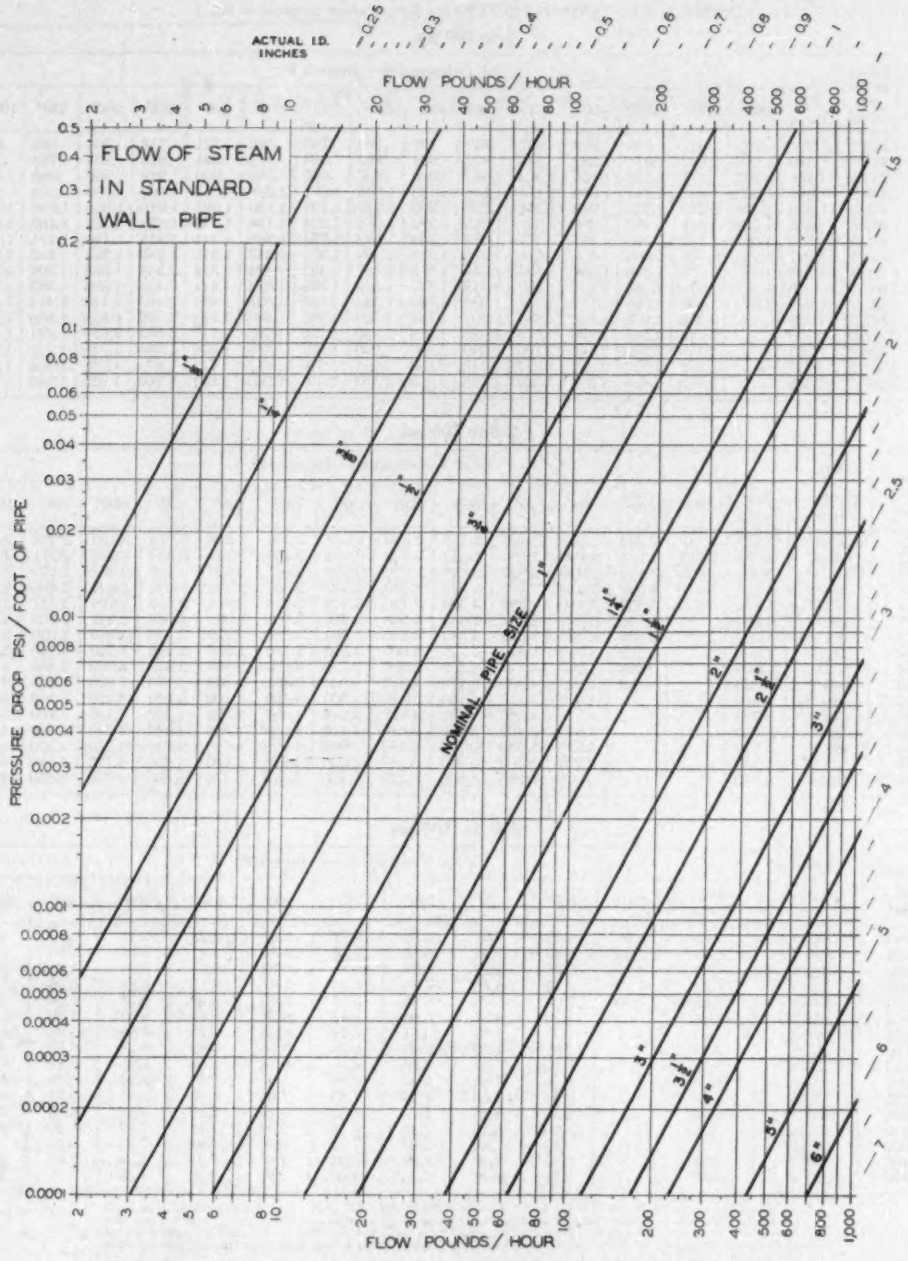
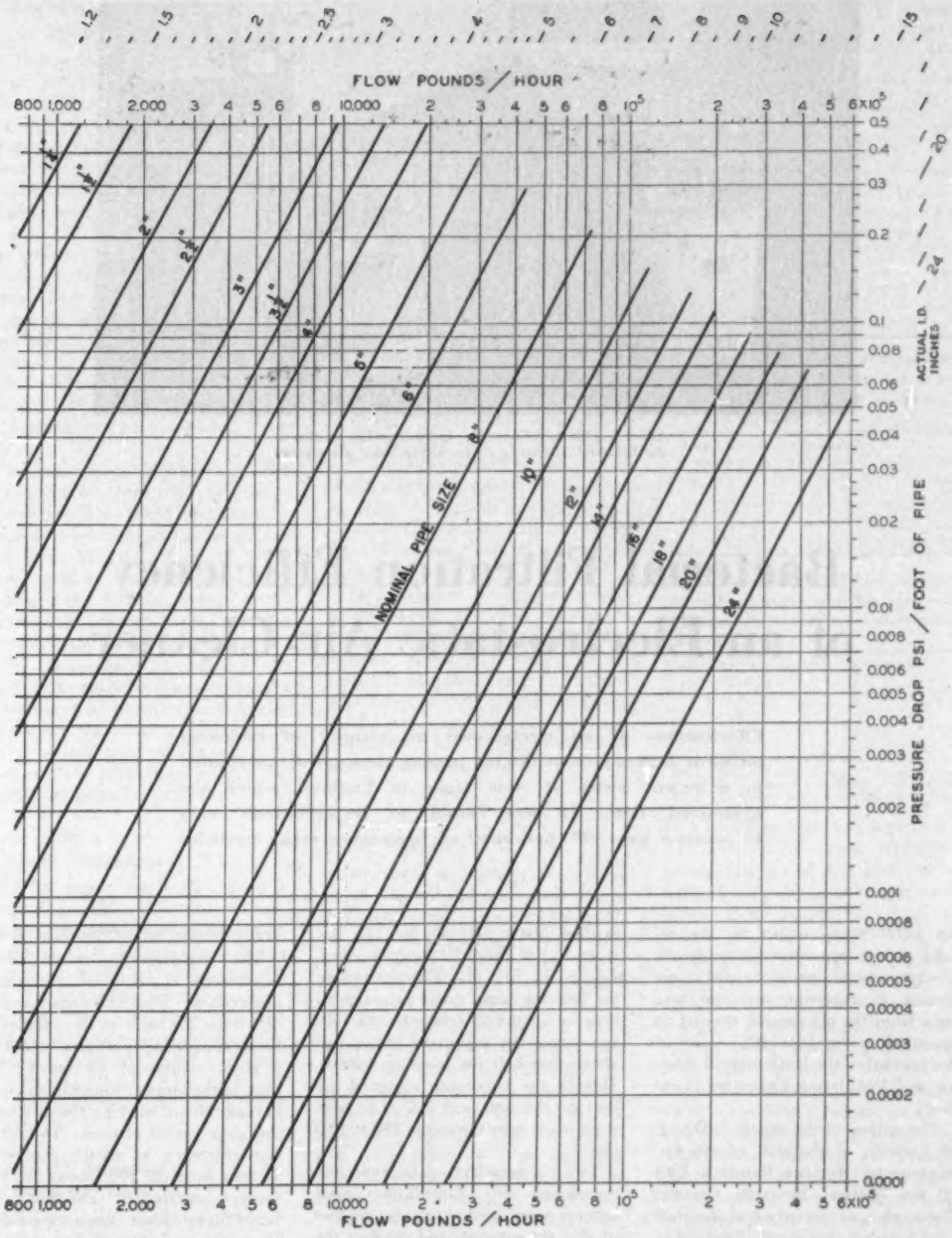


FIG. 1—FLOW OF STEAM in standard wall pipe, based on saturated steam at ½ psi gage. For a given pressure drop at other pressures and temperatures, the indicated flow will vary in proportion to the conversion factors shown in Table 1

line plus the equivalent length of all the fittings, valves, etc., which tend to alter the straight flow.

Empirical equations and charts have been devised to calculate the pressure drop with reasonable accuracy. The rational solution based on the Fanning or Darcy equation has the most universal application. The basic equation expressed in terms familiar to the piping engineer is



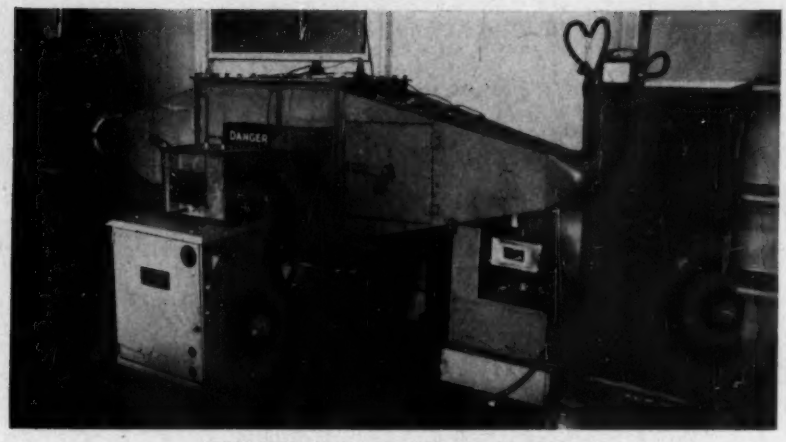
$$h_p = 0.032745\ fLV^2/dw$$

where h_p = pressure drop (psi); f = friction factor (function of Reynolds number); L = effective length of pipe (ft); V = velocity (fps); d = inside diameter of pipe (in.); w = specific volume of the vapor (cu ft/lb).

Under certain limiting conditions, sufficient accuracy in pressure drops can be determined from graphs which permit a direct plot of flow against pressure drop. Such a graph has been prepared for the flow of saturated steam and is shown in Fig. 1.

This graph is based on saturated steam at ½ psi gage. For a given pressure drop at other pressures and temperatures, the indicated flow will vary in proportion to the conversion factors shown in Table 1.

[To be continued]



APPARATUS USED by Dr. Lidwell in his studies of the bacterial efficiency of an electrostatic air cleaner

Bacterial Filtration Efficiency of an Electrostatic Air Cleaner

Effectiveness of an electrostatic air cleaner in removing airborne bacteria from the air passing through it was studied in a recent series of tests made in England, which are abstracted here. It was found to be relatively easy to remove over 99 per cent of bacteria-carrying particles

AN INTERESTING report on the results of tests made to determine the effectiveness of an electrostatic air cleaner in removing airborne bacteria from the air passing through it appeared in the June 1951 issue of the Journal of the Institution of Heating and Ventilating Engineers (London.)

The author of the report is Dr. O. M. Lidwell, of the staff of the Environmental Hygiene Research Unit of the Medical Research Council. The work was carried on at the Harvard hospital, Salisbury, England.

The electrostatic air cleaner unit tested had four ionizing wires, of 0.007 in. diameter and on 3½ in. centers, separated by a 1⅛ in. gap from five 1¼ in. diameter earthed tubes. The collecting plates consisted of two banks, each comprising 28 earthed plates, 9⅜ in. by 7⅛ in., spaced ¼ in. from 29 charged plates, 7⅛ in. by 5¾ in. The voltage on the ionizing wires could be adjusted between 10 and 15 kilovolts; the voltage across the collecting plates was always one-half the ionizing voltage. Though the maximum designed air flow of the unit was 600 cfm, tests were made over the range 190 to 650 cfm.

Two slit samplers, of the type recommended by Bourdillon and others[1], were used to obtain samples of the air entering and leaving the unit for bacteriological examination. Tests were made (1) with sprayed organisms from culture, (2) with dry spore suspensions and (3) with airborne organisms occurring naturally in the air of the laboratory.

The experimental results were "expressed in terms of percentage penetration. This has been taken as 100 times the ratio of the number of bacteria-carrying particles found in a given volume of air leaving the unit, to the number found in an equal volume of air entering the unit over the same period of time. The filtration efficiency, as usually expressed, is then equal to 100 minus the percentage penetration. The figures for penetration have been tabulated, since the majority of tests showed filtration efficiencies exceeding 99 percent, and it is easier to see the significance of five-fold reduction in penetration from, say, 0.25 percent to 0.05 percent, than of an improvement in filtration efficiency from 99.75 percent to 99.95 percent."

[1]Bourdillon, R. B., Lidwell, O. M., Thomas, J. C.: *A Slit Sampler for Collecting and Counting Airborne Bacteria*, J. Hyg. Camb., 1941 41, 197.

Tests With Sprays of Bacterial Culture

In a series of 17 tests, a "Collison type" spray[2] was used to introduce a 24 hr broth culture of a strain of salivary streptococcus. The author states that this spray produces small bacteria-carrying particles, over 90 percent containing only single or diploid cocci.

In each test the cleaner was run for at least one minute before sampling was begun, and the culture was sprayed for one minute, starting half a minute after the beginning of the two-minute sampling period. The petri plates containing a nutrient agar medium were counted after 18 to 24 hr incubation at 37 C (98.6 F). The results are summarized in Table 1.

Seventeen individual tests were also made with an "Atmozon type" spray[2] which produces larger and more irregularly shaped bacteria-carrying particles than the "Collison type" spray used in the first series. The author states that the average equivalent particle diameter of the particles produced by the "Atmozon type" spray is about 10μ, defining the equivalent particle diameter as the diameter of a sphere of unit density which has the same settling rate in air at normal temperature and pressure as the particle in question. The results are given in Table 2.

Tests with a Spore Suspension

In his report, the author gives a detailed description of the methods used to prepare a dense suspension of spores of *B. Megatherium*, mix it with fine talc powder, and disperse it into the air passing through the electrostatic filter. He notes that the suspended spore-carrying particles covered a wide size range and were of irregular shape. The results of 12 individual tests are summarized in Table 3.

"Natural" Airborne Organism Tests

It is noted that the chief difficulty in these tests was the exclusion of accidental contamination which could not be distinguished from the experimental organisms. The report discusses the test procedures as follows:

"The whole of the external casing of the cleaner unit was examined and any possible chinks sealed with plasticine. The operator worked with sleeves rolled up above the elbow, and the forearm and hand were greased with yellow petroleum jelly. A number of petri plates were inserted into the second sampler and withdrawn without taking any actual sample. The average contamination level was 0.8 colonies per plate on incubation for 20-24 hr at 37 C (98.6 F)."

After making changes to the test set-up by removing the duct work at the entrance, the investigators made an estimate of particle size by exposing petri plates just outside the cleaner entry. "These plates were covered by a U-shaped piece of metal about 1 ft long, the partial tunnel formed being about 1 ft deep by 9 in. wide, in order to prevent any large particles, which would not be carried by the air stream, from falling on to the plates."

Table 4 gives a summary of the results of 48 individual tests made with sampling periods of 15 to 30 minutes. Though, as might be expected, the bacteria-carrying particles occurring naturally in the air of the laboratory were varied in size, shape and density, the average equivalent particle diameter is given as about 17μ.

Discussion of the Results

Discussing the results, the author states, "In view of the varied nature and size of the test particles used, the relative uniformity of the filtration efficiency under similar conditions of voltage and air flow revealed by Tables 1—4 is notable. The reason for the rather low figures, 56-70 percent, obtained for the penetration of the test particles, other than the spore suspension, with the power-supply switched off, is not clear and may be connected with the nature and disposition of the sampling tubes. It was not practicable to attempt isokinetic sampling conditions.

"The penetration of the naturally occurring airborne organisms may possibly be over-estimated. The penetration appeared to fall off as the experiments proceeded. This is reflected in Table 4; the experiments at an air flow of 450 cfm were all among the earliest carried out and, those at 190 cfm among the last.

TABLE 1—PENETRATION percent of a "fine" spray of bacterial culture. Approximate particle diameter, not exceeding 3-4μ

Flow through air cleaner (Cfm)	Wire voltage 0	13 kv	15 kv
340	56	0.27	0.24
450	56	0.94	0.40
650	56	2.2	1.03

TABLE 2—PENETRATION percent of a "medium" spray of bacterial culture. Approximate mean particle diameter, 10μ

Flow through air cleaner Cfm	Wire voltage 0	13 kv	15 kv
340	60	0.33	0.20
450	60	1.4	0.39
650	60	3.5	0.96

TABLE 3— PENETRATION percent of spore-bearing talc powder Approximate mean equivalent particle diameter, 5μ (20 percent below 2μ)

Flow through air cleaner Cfm	Resistance to air flow In. of water	Wire voltage 0	15 kv
190	0.1	100	0.045
340	0.2	100	0.089
650	0.6	100	0.26

TABLE 4—PENETRATION percent of naturally occurring air-borne organisms*. Approximate mean equivalent particle diameter, 17μ

Flow through air cleaner Cfm	Wire voltage 0	15 kv
190	70	0.56
340	70	1.5
450	70	2.1
650	70	1.9

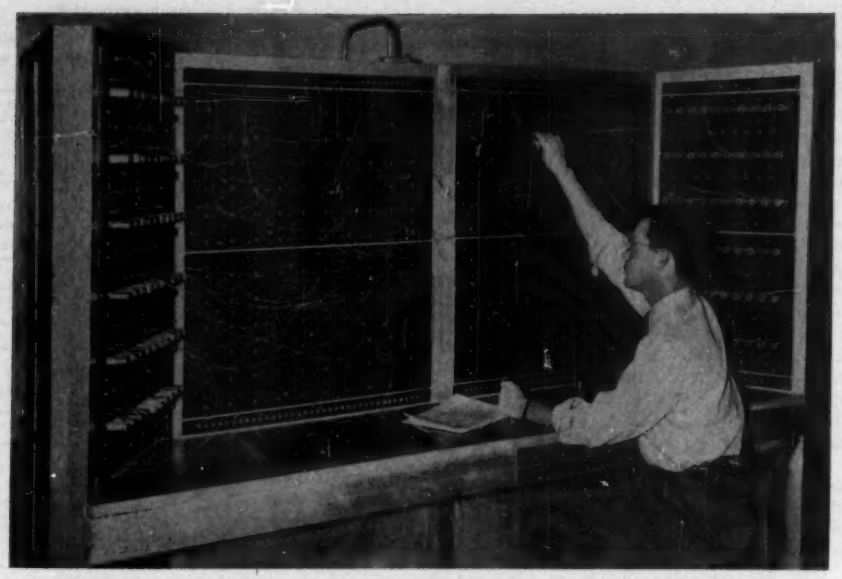
*The contamination level of the petri plates exposed without actual sampling has been allowed for in calculating the percentage penetration.

It is possible that this was due to the inside of the cleaner releasing a certain number of dust particles initially, from a site or sites which were blown clean in the course of the tests.

"In general, it will be seen that penetrations of less than 1 percent could be readily achieved with all the types of bacterial particles tested without undue limitation of the air flow. The apparatus was not designed to reduce the penetration to much lower levels, which would be without significance in normal air conditioning although of considerable interest for particular purposes, and no attempt was, therefore, made to ascertain the minimum penetration values which could be achieved by still further reducing the air flow."

Further discussion of these results is invited by the Institution of Heating and Ventilating Engineers, and should be addressed to the Secretary, 75 Eaton Pl., London S.W. 1, England.

[2]Rourdillon, R. B., Lidwell, O. M., Lovelock, J. E., and others: *Studies in Air Hygiene*. Medical Research Council Special Report, Series No. 262, 1948 (a), p. 58; 1948 (b), p. 320.



PIPING DISTRIBUTION SYSTEM calculator developed and placed in operation by Institute of Gas Technology simplifies gas utility problems, can be used also in studies of steam flow.

New Electric Calculator Solves Piping Problems

The Institute of Gas Technology has developed and placed in operation a distribution system calculator which in a few hours performs calculations of flow patterns and pressures and thereby eliminates days or weeks of study. Constructed primarily for investigating gas systems, it can also be used in steam distribution work

A DISTRIBUTION SYSTEM calculator which in the space of a few hours performs calculations of flow patterns and pressures, eliminating days or weeks of study required to obtain similar data by other means, has been developed and placed in operation at the Institute of Gas Technology in Chicago.

Piping Distribution Problems

The various problems of the gas distribution engineer of every utility company have this in common: the requirement of providing satisfactory service by the most economical means. These problems include:

1) Checking the character of the flow pattern in the present mains and the adequacy of the system of mains to meet load requirements.

2) Modification of the existing distribution system to meet increased loads.

3) The design of optimum or ideal layouts of mains to be used as guides in the development of new areas.

The volumes of gas flowing through a given section of a distribution system are seldom measured; they are usually calculated from pressure measurements in governor pits and computed service requirements based upon customer appliance demands (with appropriate diversity factors). When the section of pipe is operating as a part of a grid system — with interconnected mains and the multitude of services commonly associated with grid systems — evaluation by the usual methods of a particular section's operation is virtually impossible.

The complexity of the study is compounded if a complete survey of a system is attempted, for that requires pressure and flow rate measurements at every governor pit, main junction, and service in the system. After these data are obtained, infinite calculations are necessary for their interpretation.

Development of Calculator

With the objective of simplifying distribution system calculations, the institute in 1950 began a study of the possible use of a calculator which

would utilize similarities between the flow of electricity and the flow of gas:

ELECTRICITY	GAS
Voltage at source	= Pressure at source.
Voltage difference due to resistance	= Pressure drop due to friction.
Current through resistor	= Flow rate through pipe.
Current consumed by load device	= Volume taken by consumer.

No electric calculator entirely suited to gas distribution studies had yet been reported. Last January, development of such a calculator was initiated as an institute project with B. E. Hunt as project supervisor.

Except that certain electronic components of the calculator require a 110 volt a-c power supply, the instrument is operated on direct current; its wattage requirements are low, and an ordinary radio B battery provides the current used in the circuits employed in calculation.

The instrument has resistance components sufficient to permit the simulation of 240 sections of pipe. It has 120 load devices to represent up to that number of services or concentrated loads. There are enough positive terminals to allow calculations based upon as many as 48 points of supply.

The panels are so constructed that if it is desired to study the effects of a pipe line failure, the network can be connected directly to the negative side of the battery. Two sets of meters and meter circuits are provided, and halves of the panel can be separately used in the simultaneous study of two problems. Provision has been made for connecting additional resistor and load panels to increase the capacity of the calculator.

Operation of Calculator

To set up a problem, a map of the distribution system is required. On it, all pipe line diameters and lengths must be marked, and gas requirements in MCF per hr indicated at the points of demand throughout the system.

The operator of the calculator then marks the map to identify each pipe section and load of the system with a resistor and load device of the instrument. A figurative model of the system is set up on the calculator by connecting the resistors and load devices in the proper sequence.

The electric current is introduced at the point(s) on the instrument corresponding to the source(s) on the system.

Each resistor is then adjusted to a value corresponding to the resistance to flow in a pipe of the length and diameter specified. The load devices are adjusted to consume current proportional to the gas demand at the positions shown.

The current at the source(s) is set proportional to the gas flow at the source(s). When the gas flow is unknown but the pressure is known, the voltage is adjusted proportional to the pressure.

Subsequent adjustments of the resistors are made until the network is electrically balanced. The current through each resistor is measured, yielding a figure for the gas flow in that pipe section. The voltage is then measured to establish a figure for the pressure at that point.

The meter readings are readily converted to gas flow rates and pressures.

The rapid increase in urban population and expanded use of gas for space heating have placed unprecedented demands on existing distribution systems. Many companies have been unwilling to assume increased load, being fearful of the adequacy of their distribution system capacities. Some of these systems may be adequate; the institute's calculator can aid in evaluation of their capabilities.

Use of the calculator in extending existing systems might result in a solution indicating that modification of the system is necessary. The problem would then be carried into this second phase: the distribution engineer of the utility company would indicate possible locations of new feeder mains or regulators, and by use of the calculator could explore all design possibilities to determine which alternative would be most efficient.

The calculator is especially time-saving in these additional analyses. Many locations can be tested in succession without the fatiguing calculations which normally accompany such a task. The calculator also determines the best solution, instead of accepting the first selected at random.

In planning a new distribution system, an engineer can avoid months of calculation by merely submitting a map of the proposed system, with anticipated demands marked on it. The problem can be set up on the calculator, and by rapid trial-and-error methods the optimum layout will be determined, including pipe sizes and regulator locations.

The institute's instrument is available to all members of the gas industry, regardless of whether they are institute members, at a nominal charge to cover the cost of the instrument and the operating engineer's time. The Institute of Gas Technology, which is the gas industry's own educational and research facility, will welcome inquiries on distribution system studies.

Can Be Used for Steam Flow Studies

On page 88 of the September HPAC, in a report on the annual meeting of the National District Heating Association, a paper on using a calculating table for studying flow in district steam piping systems was summarized. The authors of that paper presented the following conclusions:

1) The formulas cannot be made directly analogous to the relation utilized in the d-c calculating table.

2) The table cannot be used for determining directly the flow-pressure gradients in a loop type steam system.

3) After gradients in a loop type steam system have been assumed as is done analytically, the assumptions may be checked on a d-c table, but the time required to make this comparison equals or exceeds the analytical check.

In commenting on these conclusions, Mr. Hunt (of the Institute of Gas Technology) says: "While there is no direct analog between the flow of gas and the flow of electricity, a computational procedure has been developed which will permit the use of a limited electric analog. This procedure gives the pressure gradients in the system, and the flows. While our calculator has been constructed primarily for study of gas distribution systems, it is equally suited to study of steam distribution systems."

E. S. Pettyjohn, of the Institute of Gas Technology, has advised HPAC's editors that if any of HPAC's readers are interested in submitting a steam distribution problem, the institute will be pleased to undertake its solution. Data on physical characteristics of the piping network, the loads at the service outlets, and either pressure or flow at the system's source(s) would be required.

Fan Noise Ratings "Should Depend on Human Element"

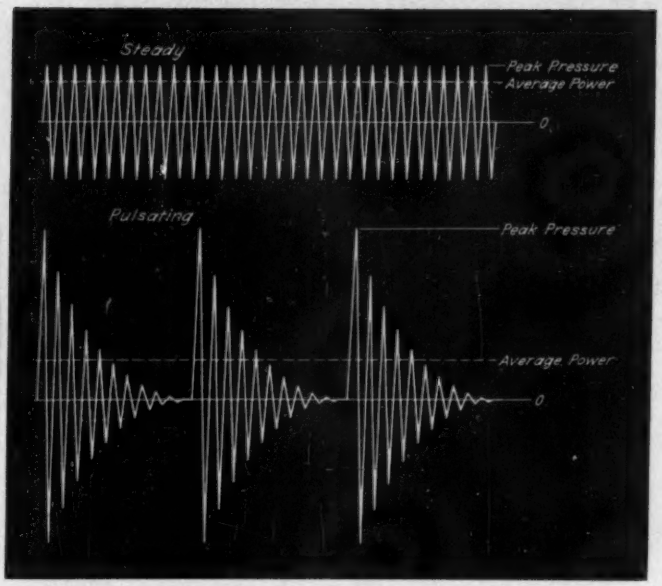


FIG. 1 — TWO SOUNDS OF SAME frequency and equal intensity are compared in this diagram, which indicates that the peak sound pressures are much greater with a pulsating sound

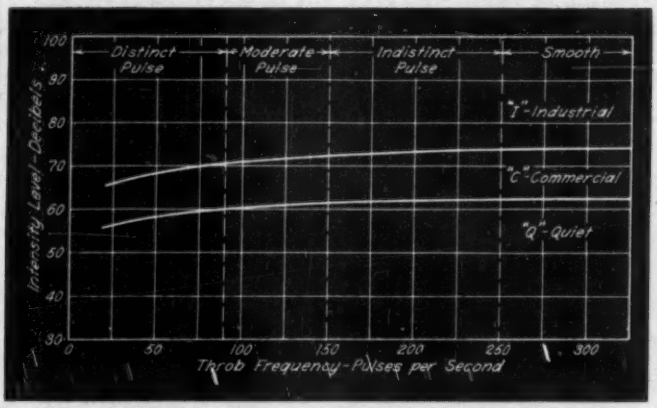


FIG. 2 — SUGGESTED METHOD for combining intensity and annoyance factors, and author's suggestions for rating air moving equipment as "Q", "C" or "I"

MR. CURRIE'S November issue comments on testing fans for noise level referring to my remarks in the "Open for Discussion" section of the October HPAC bring out the key point that I have been trying to make.

As Mr. Currie says, fan ratings such as I propose are *dependent on the human element.* Isn't the human element the key to the original choice for installation and final satisfaction in operation of air moving equipment? Isn't the annoyance factor the basic reason why we seek some fair method of measuring and rating propeller fans for comparative purposes?

If so, we must realize that we cannot pinpoint the specification, because there is a broad acceptance band due to the variation in the human element and because the ambient noise level of each installation will affect the noticeability of the fan noise level. This is not simply an unsubstantiated opinion of my own but the opinion of leading authorities in the field of acoustics. For this reason, the engineer should welcome a departure from his usual goal of pinpoint specification and recognize the fact that he is dealing with a highly controversial problem.

It is generally conceded that present sound rating provisions do not cover the field satisfactorily and are developing some very ambiguous specifications. Acceptance of orders under specifications written into many bids may prove costly to fan manufacturers.

It is my opinion that a sound rating code should be developed which allows for the human element, as pointed out by Mr. Currie. Such a system would involve decibels as a measure of intensity and, to be realistic, would blend with this a factor representing annoyance. Such a factor involves tip speed and throb frequency as pointed out in my original article in the June HPAC.

Perhaps the accompanying diagram, Fig. 1, will make this point clear. It represents two sets of sound waves of the same frequency and of equal intensity level (equal decibel level, as measured by meter). The upper is a steady sound and the lower is a series of sound pulses such as might be produced by pounding an anvil with a hammer. It is clear that the peak sound pressures must be far greater with a pulsating sound than with a steady sound, if the average sound power (decibel level) is to be the same for both. It is these pressure waves which vibrate the eardrum and register annoyance.

Suggested Method of Rating

Intensity and annoyance factors could probably be combined by plotting decibels measured on a flat response network against throb frequency in pulses per second, as indicated in Fig. 2. Perhaps air moving equipment falling below the curves would qualify for a quiet or "Q" rating; air moving equipment falling between the curves might qualify for a commercial or "C" rating; and air moving equipment above these curves could be rated industrial or noisy and carry an "I" designation. Such a symbolic rating would have the advantage of de-emphasizing exact decibel ratings and placing noise ratings in broad acceptance bands where they really belong. No longer would users be led to believe that a certain 69 db fan is necessarily quieter than a competing 74 db fan. Of course, we could go on and refine this method still further by bringing in many other criteria — such as sharpness of the pulses (duration time) and air velocity, — but these are fairly well taken into account by the combination of intensity level and throb frequency. In any case, over-exactness or pinpointing is to be avoided if it fails to carry with it a means of comparison with other ratings.

It certainly would be convenient if the Fletcher & Munson loudness level curves (see Fig. 1 of the original article in the June HPAC) could be used to rate fans in phons. However, these are based on ear response to a pure tone, which is defined as a sound of single frequency and sinusoidal wave shape. A sound may be analyzed into its component frequencies and the intensity level of each component determined. The Fletcher & Munson curves will indicate the ear response in phons of each frequency for the particular intensity level measured, but there is no simple way of telling how the ear will respond to the *combination* of the various frequencies. Two musical notes struck simultaneously sound pleasant when they harmonize but are quite annoying when discordant. Again, if one were to compare the pulsating sound of Fig. 1 with the Fletcher & Munson loudness level curves, he would be led to believe that the introduction of the pulse frequency would result in lower ear response for the whole. Obviously, such is not the case.

Based upon several years study of the sound problem, it is my personal opinion that some system involving annoyance factor and intensity is the only practical solution for comparative rating on a controversial problem.

R. A. Gerlitz, Chief Engineer, Propellair Div., Robbins & Myers, Inc., has noted a growing trend toward stating maximum noise levels for propeller fans in consulting engineers' and architects' specifications, without qualification as to noise quality or the noise rating test setup. He therefore prepared an article published in the June 1951 HPAC to explain the characteristics of the noise emanating from a propeller, to point out that two fans with equal noise levels are not necessarily equally acceptable to the ear, and to show that a noise rating is not a precise quantity which can be checked and confirmed in any test room . . . . . Following publication of the June article, considerable comment on the question has appeared in HPAC's "Open for Discussion" columns, and has resulted in this second article on the subject by Mr. Gerlitz

EFFECTIVE TEMPERATURE SCALE NEEDS INVESTIGATION

I AM SORRY THAT my article on equivalent temperature, in the August 1951 HPAC, has caused concern to Professor Jordan and Professor Rowley, as evidenced by the comments on page 73 of the November issue. That was not my intention.

Professor Jordan admits that the data presented by himself and his colleagues could lead to the conclusions I drew, and I am not clear how the qualifications quoted in the November issue by Professor Jordan invalidate those conclusions.

From the numerical data published in the paper in the ASHVE Journal Section of HPAC in June 1947, I drew the conclusions set out in my August 1951 article — namely, that the feelings of warmth experienced by the subjects of Professor Jordan and his colleagues appeared to be more closely related to dry bulb temperature than to effective temperature, and that no influence of relative humidity was observed. I maintain that those conclusions were valid ones. I find it difficult to understand how the lapse of time between the collection of data and their analysis should affect the results of the analysis, or why the facts that "the original data were not taken by the authors and were not taken with the present analysis specifically in view" should influence the conclusions, so long as the data are accurate.

I referred to these data as supporting the view that in the conditions encountered in many American buildings the equivalent temperature scale is a valid scale of warmth. I still think that they do support that view.

As far as the effective temperature scale is concerned there is, I think, no conflict between Professor Jordan and me. He admits that the effective temperature scale needs further investigation, and I agree with him. In the past few years various criticisms have been levelled at effective temperature, and work done during the war years has shown its defects at high temperatures approaching the tolerable limit. Yet, in spite of any defects the scale may have it has been — and even now remains — a valuable aid to the heating, ventilating and air conditioning engineer. —THOMAS BEDFORD, Environmental Hygiene Research Unit, (Medical Research Council), London School of Hygiene and Tropical Medicine.

Air Conditioned Offices for T. P. & W. Railroad

By S. Alan Baird, Consulting Engineer, and Carter E. Hewitt, Architect

A feature of the Toledo, Peoria & Western's new air conditioned office building is the method of taking return air through a continuous slot in the floor, over which the plaster partitions were constructed. This and other details of the job are described

DESIGN OF THE AIR conditioning for any office building requires careful study of the building — its exposure, occupancy and utilization of the various areas. When the building is designed without windows, some design problems — such as sun effect through glass areas — are simplified but additional factors which are normally overlooked must be taken into account if the system is to operate properly and provide the occupants with year 'round comfortable working conditions.

In office areas without windows, the space must be well illuminated artificially and lights will be used at all times when the building is occupied. In the new Toledo, Peoria & Western Railroad office building, Peoria, Ill., the work areas have from 4 to 4½ watts per sq ft of fluorescent lighting. With this amount of sensible heat gain from lights, plus the occupant load, there are many days in the spring and fall when cooling is necessary and can be accomplished by using nearly 100 percent outside air rather than by operating the mechanical refrigeration. If the system is using 100 percent outside air, and there are no windows, excess pressure will occur unless special care is taken to make provisions for venting or exhausting air.

Normal operation, in winter and in weather which requires mechanical refrigeration for cooling, demands only a minimum of outside air in an amount sufficient only for the ventilation requirements of the occupants. This amount of air will normally vent through toilet and kitchen exhaust fans, and vestibule openings of entrances and secondary doors.

The T. P. & W. buiding is rectangular, 145 ft by 80 ft. The main floor has private offices, the entrance foyer, toilets and business machine work areas around its perimeter, and a 125 ft by 50 ft general office space in the center, without partitions or obstructions. The basement area is in general below grade on three sides, with a few window areas in the dining room and rear entrance foyer. The basement includes a kitchen, dining room, stationery stockroom, archives and space allocated for future expansion of general office space as may be required.

The building is heated by baseboard type radiation installed around the perimeters, using steam supplied by a 35 hp low pressure gas fired boiler. Steam is also used in the air conditioning equipment for tempering air for ventilation purposes. No attempt has been made to use the air conditioning system for heating, except in the zone on the west side which contains four offices and the reception area. The reception area has some glass and double entrance doors, and a steam booster coil was added so that air for this reception area can be heated at times when the control may be providing cool air for the four offices on the same zone.

Divided Into Seven Zones

The building is divided into seven zones, each with a separate thermostat control. Like areas were placed on the same zone, to keep costs for control to a minimum but still to allow for flexibility in sufficient degree that all areas are kept comfortable the year 'round.

The zones in general are:

Zone 1....Basement south exposure.
Zone 2....1st floor machine room south exposure.
Zone 3....1st floor balance of south exposure.
Zones 4 and 6...1st floor central work area.
Zone 5....1st floor west exposure.
Zone 7....1st floor north exposure.

The air conditioner unit is custom-made and is in the basement. It includes a blow-through fan to handle 18,000 to 20,000 cfm of air, cleanable filters for both outside and return air, a steam coil and a "Freon" direct expansion coil. Each of the seven zones is equipped with a set of dampers arranged either to cool or temper the air at the demand of the zone thermostat. This face and bypass arrangement was selected for flexibility and because some zones will be cooling (particularly the central work area) when private office areas along the north exposure may require tempered air at the same time.

Pneumatic control was selected to operate the zone steam valves and the heating and zone dampers. The control provides true gradual action of valves and dampers and in conjunction with the bypass damper arrangement makes possible holding a constant temperature in the conditioned spaces.

Refrigeration is provided by a 56 ton compressor driven by a 60 hp, 480 volt motor. The compressor is fitted with capacity reduction and will operate continuously over a wide range of loads without starting or stopping. It is arranged for across-the-line starting with 480 volt, three phase power supplied by a bank of transformers separate from the three phase 120/208 volt bank of lighting transformers.

The refrigeration cycle is completed with a direct expansion coil

in the conditioner unit and an evaporative condenser located at grade, just outside of the building adjacent to the compressor. Ducts from the conditioner run up to the first floor ceiling — except for the basement zone, where the ducts run on the basement ceiling — and distribute to the offices and the central area. Ducts run around the outer perimeter of the interior work area and distribute air to the offices and work area through side wall grilles of the double deflection type.

Novel Method of Returning Air

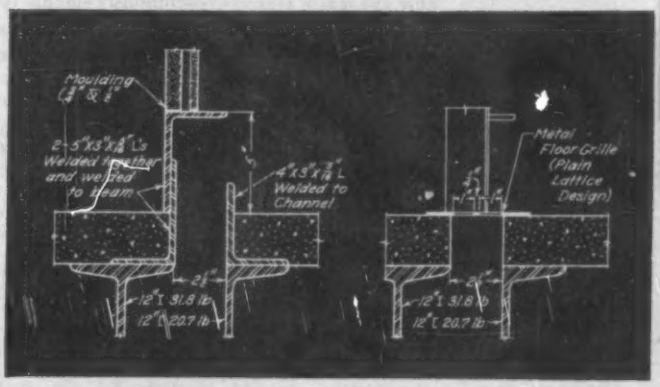
A novel method of returning air from the conditioned spaces to the conditioner was developed to save floor space that would have been lost if conventional returns and ducts were used.

All interior partitions are 1½ in. thick solid plaster. Floor construction consists of 2½ in. of concrete slab on steel joists.

The plaster partitions common to the central work areas and the perimeter office areas, were constructed on a 5 in. by 3 in. angle set over a 2½ in. wide continuous slot in the floor.

The slot was framed with a 4 in. by 3 in. angle and a 5 in. by 3 in. angle. At door openings, the 2½ in. slot was covered with a perforated grille similar to a threshold. Return air from the central work space or perimeter offices passes through the slot into the joist space above the basement ceiling. Return air ducts on the basement ceiling open into each bay of the framing and return the air from between the joists of each building bay.

A NOVEL METHOD of returning air to the conditioner is shown in this photo and the sketches


Moulding
Welded together and welded to Beam
Welded to Channel
Metal Floor Grille (Plain Lattice Design)
12" I 31.8 lb
12" I 20.7 lb

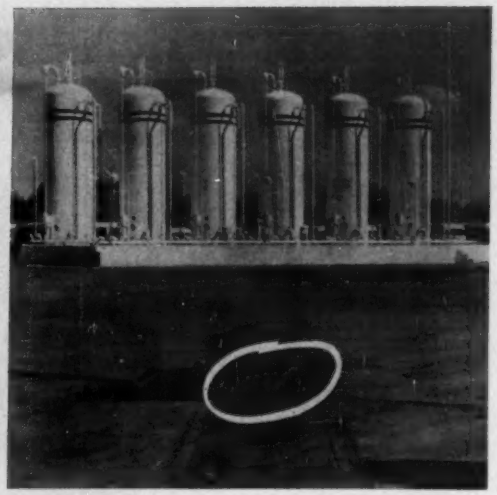
THE SLOT CONSTRUCTION devised to handle the problem of air returns where ultra-thin partitions are used. At doors, metal floor grille (right) covers the slot

REPORTS RECORD SALES

CONSOLIDATED NET SALES of The Trane Co. and its Canadian subsidiary — manufacturers of air conditioning, heating and ventilating equipment — were $26,693,047 for the nine months ended September 30. This figure represents a 41 percent increase over the sales for the same period of 1950, according to D. C. Minard, president.

Shipments of industrial steam and hot water unit heaters during the first nine months exceeded total annual sales for either 1942 (record wartime year) or 1947 (record peacetime year), Mr. Minard said.

TRANSPORT TRUCK UNLOADING station (left) is protected by water fog sprinkler mounted on the reinforced concrete buffer. The station is several hundred feet from the storage tanks. At left may be seen one of the air sampling tubes for the combustible gas alarm. The mechanical filter of the tube is circled



PROPANE STORAGE TANKS (right) are surrounded by a reinforced concrete wall serving as a dike and buffer. An important safeguard is the automatic continuous combustible gas sampling and analyzing alarm system. One of the sampling intakes (circled) was lifted from the underground pipe trench temporarily for this picture

Gas Alarms Sample Atmosphere for Propane Bus Fueling

At the San Antonio Transit Co.'s new storage and maintenance facilities for its fleet of propane motor buses, combustible gas alarm systems continuously sample the atmosphere at eight different locations in the storage unloading area and fueling rack, the pipe trench and the service building

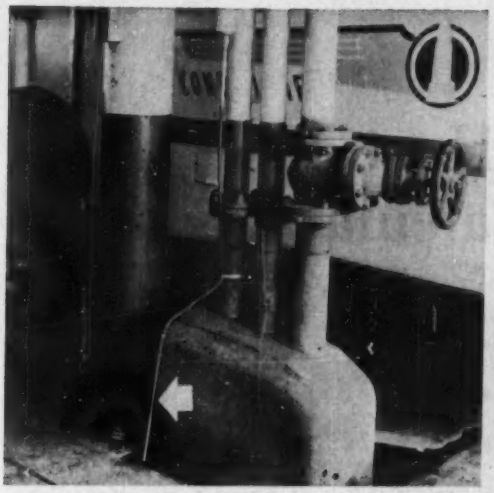
USE OF PROPANE as a fuel for motor buses has created new problems in storing and handling large quantities of this highly volatile compound, which is a gas in normal atmospheres and a liquid under pressure. The San Antonio Transit Co. recently built new storage and maintenance facilities which are designed for maximum safety to minimize fire and explosion hazards.

The Hudson Engineering Co., Houston, assisted in designing the new plant, and the fire prevention and engineering bureau of Texas and the health and safety division of the U. S. Bureau of Mines participated as consultants. As a result of the combined efforts of the owners, designers and consultants, the new facilities are described as a "model" for this type of operation.

One of the chief problems concerned a method for accurately detecting and reliably warning of combustible concentrations of propane in the atmosphere around storage tanks, piping, valves, fueling station and repair pits. This was solved by the installation of multi-point combustible gas alarm systems. Two separate systems are used — one to protect the outdoor storage and loading and unloading facilities and the other to serve the repair zone inside the modern steel and glass maintenance building, which has a floor area of some 45,000 sq ft.

Atmosphere Sampled at Eight Points

These two combustible gas alarm systems continuously sample the atmosphere from eight different locations, analyze the samples and



BUS FUELING STATION (left) is outdoors, covered by a canopy. The line which continuously samples the surrounding atmosphere for propane concentrations is shown (arrow) extending down pipe column to floor level. Each sampling line has a mechanical filter to remove dust from the air. The fueling dock is protected by water fog sprinklers. . . TO DETECT immediately any propane leaks in piping, pumps or valves at the storage tanks, one air sampling intake is located there (right). It is shown (circled) in the trench. Propane gas is heavier than air and sampling points are thus located in low spots.

instantly warn when the gas-air mixture reaches 40 percent of the lower explosive limit. This enables personnel at the terminal to take remedial action immediately.

Four sampling lines run to each alarm panel. The system that protects the storage unloading area and fueling rack has one line running 240 ft from the instrument to the six 5000 gal propane storage tanks. Tanks, valves and piping are inside a 2½ ft high concrete fire wall. Another sampling head is in the covered trench that contains fuel lines from the storage tanks and the fueling rack. Another line draws samples from the propane unloading dock above 75 ft from the instrument panel, and the fourth line serves the bus filling station.

About 300 ft west of the filling station, which is an outdoor canopy-covered area, is the service building and warehouse. The second four-point gas alarm samples air from repair pits in this building. Some propane might conceivably escape through leaks in carburetor lines or fittings, and pressure relief valves on the tanks. Fuel in tanks filled outdoors on a cold day might be liberated through pressure relief valves if the buses are moved inside and warmed up, as temperature rise of course causes the propane gas to expand. Because propane is so volatile and the fuel systems are under pressure, contamination of the atmosphere would occur faster than with fuels of lower volatility. For this reason, the automatic alarm system is designed to provide a warning long before the air becomes dangerously contaminated.

In cities where the weather is cold during the winter months, the need for a positive, instantaneous gas detection and alarm system is even greater than in warmer climates, due to this gas expansion problem.

The outdoor filling station at San Antonio is equipped with a water fog system manually operated from points close to the fueling rack. Water fog systems also are provided for the unloading dock and storage tanks. The terminal itself covers several acres. The area is uncrowded, which is conducive to good housekeeping — an essential part of any well-balanced safety program. Buses are stored in the open.

How Gas Alarms Operate

The combustible gas alarm systems, which can be adapted for use with nearly all known combustible gases, are explosionproof and so can be mounted in hazardous areas. In operation, air samples are drawn into the instrument and passed over one of two heated sensitized platinum filaments which form a balanced electrical circuit. One filament, known as a compensator, is sealed in a cell containing uncontaminated air. Any combustibles present in the air sample are burned on contact with the other filament, known as the detector. This raises its temperature and its electrical resistance, unbalancing the circuit.

The degree to which this circuit is unbalanced is proportional to the concentration of combustibles in the sample. This is measured by an indicating contact-making meter, which is designed so that when the needle reaches a predetermined point, a magnetic contact is closed to energize the alarm signal circuit. At the San Antonio installation, the alarm consists of a red light flashing on the instrument panel and a horn sounding. The instrument also can be arranged to automatically operate ventilation systems or to actuate any other mechanical equipment.

Air samples are constantly drawn through the lines to the instrument by means of a turbo compressor. Indicator lights on the panel of the instrument show from which area the contaminated sample was taken.

[Photos courtesy Mine Safety Appliances Co.]

Effective Heat and Heat Loss Calculations

By C. O. Mackey and N. R. Gay
Professor and Associate Professor
of Heat-Power Engineering
Cornell University

Why does the heat loss of a structure depend upon the type of heating used and why, then, is the conventional heat loss calculation incorrect? And what should be done about it — nothing, "adjust" capacity tests, or "adjust" heat loss calculations? The purpose of the authors in this article is to try to establish agreement on some of the basic and fundamental principles of heat transfer involved in these questions

IN A RECENTLY presented paper, a controversial question of long standing was revived. The question has its origin in the fact that numerous tests of radiators and convectors show the rate of heat loss from a given structure (for a given outdoor environment and a fixed air temperature at some point in the enclosure) depends upon the method used to heat the structure. Discussion of the paper showed a lack of agreement upon some very basic and fundamental principles of heat transfer. The purpose of the present article is to try to establish agreement on some of these principles.

Why does the heat loss depend upon the type of heating used and why, then, is the conventional heat loss calculation incorrect?

First, the floor to ceiling air temperature differential affects the heat loss.

For ceiling heights under 10 ft, it is quite common to assume that the air temperature at every point in the enclosure is the same as the indoor air temperature at the breathing level. As a consequence, since the floor to ceiling air temperature differential depends upon the type of heating or heating unit used, the actual loss of heat from the structure may be different from the calculated heat loss.

Second, the heating unit may be installed in direct contact with an exterior wall of the structure. When this happens, the local conduction of heat through the wall is far greater than that estimated in the conventional calculation of heat loss.

Third, even if the heating unit does not touch an exterior wall directly, it may be mounted in such a position that the local temperature of the room-side surface of the wall is of the order of 100 F to 150 F. For the conventional calculation of heat loss by transmission, the assumption is that the temperatures of all room-side surfaces do not exceed the design indoor air temperature, and this may be far from the actual condition.

Fourth, the assumption is commonly made in calculating heat loss by transmission that the room-side surface coefficient of heat transfer by combined radiation and convection is 1.65 Btu per hr sq ft for each degree of temperature difference between the room-side surface and the room air. This may be a poor assumption, and the laws of heat transfer, as they affect this combined coefficient, may need explanation.

In the absence of large velocities of air flow over room surfaces, these surfaces exchange heat by natural convection with the room air. For *vertical* surfaces either warmer or cooler than the room air by Δt deg F, an empirical equation for this surface coefficient of convection is

$$h = 0.27\ \Delta t^{0.33} \text{ Btu per hr sq ft F} \quad \ldots\ldots [1]$$

For ceilings warmer than the air or floors colder than the air, this surface coefficient is

$$h = 0.20\ \Delta t^{0.33} \text{ Btu per hr sq ft F} \quad \ldots\ldots [2]$$

For floors warmer than the air or ceilings colder than the air,

$$h = 0.38\ \Delta t^{0.33} \text{ Btu per hr sq ft F} \quad \ldots\ldots [3]$$

There is also an interchange of radiant energy between room surfaces. Surfaces with an absorptivity of 1.0, when separated by a fluid that does not absorb radiation, exchange energy in accordance with the Stefan-Boltzmann law:

$$q = 0.173\ A_1 F_{1,2}\left[\left(\frac{t_1 + 459.7}{100}\right)^4 - \left(\frac{t_2 + 459.7}{100}\right)^4\right] \quad \ldots\ldots [4]$$

where A_1 = area of surface 1, sq ft; $F_{1,2}$ = the angle factor from surface 1 to surface 2, or the fraction of the radiation emitted from 1 which is incident on 2; t_1 = temperature of surface 1, F; t_2 = temperature of surface 2, F.

An equivalent surface coefficient of heat transfer by radiation (Btu per hr sq ft F) is often used and defined as

$$h_r = \frac{0.173\left[\left(\frac{t_1+459.7}{100}\right)^4 - \left(\frac{t_2+459.7}{100}\right)^4\right]}{t_1 - t_2} \quad \text{[5]}$$

Numerical values of such an equivalent surface coefficient are given in Fig. 1 for a range of t_1 and t_2 common in heating or cooling calculations.

An illustration of the meaning of the surface coefficient of heat transfer by combined radiation and convection will now be given: A vertical wall with an absorptivity for radiation of 1.0 at a temperature of 60 F receives heat by convection from still air at 70 F and by radiation from an enclosing "black" surface at 75 F; what is the surface coefficient of combined heat transfer?

The rate of heat transfer by convection from air to wall is

$q_c = 0.27\ (10)^{1.33} = 4.8$ Btu per hr sq ft

The rate of heat transfer by radiation from the enclosing surface is

$q_r = 0.173\ (5.347^4 - 5.197^4)$
$= 15.2$ Btu per hr sq ft

[Note that q_r is also $h_r\ (75 - 60) = 1.015(15) = 15.2$].

The total rate of transfer by combined radiation and convection to the wall is $q_t = 20$ Btu per hr sq ft.

The surface coefficient of heat transfer by combined radiation and convection *per degree of temperature difference between air and wall surface* is

$h = (20/10) = 2.0$ Btu per hr sq ft

This particular value is correct only for the case under consideration.

Assume, next, that the temperature of the wall surface is 60 F and the temperature of the room air 70 F (as in the previous case) but let the average temperature of the surfaces enclosing the wall be 65 F instead of 75 F. In this case, $q_c = 4.8$ Btu per hr sq ft but $q_r = 0.173(5.247^4 - 5.197^4) = 0.985(65 - 60) = 4.92$ Btu per hr sq ft. In this case, the surface coefficient of heat transfer by combined radiation and convection *per degree of temperature difference between air and wall surface* is

$h = (9.72/10) = 0.972$ Btu per hr sq ft

The numerical examples show the dependence of the value of this surface coefficient upon the various surface temperatures within the room as well as upon the air temperature.

Analysis of some simple heat transfer problems by the method of energy balances will now be made with the purpose of showing that this surface coefficient of combined heat transfer and the transmission heat loss depend upon the type of heating or heating unit used to warm a given enclosure.

In every case, the room is 12 ft by 15 ft with an 8 ft ceiling. There is one exterior wall — a 15 ft wall — in which there are two 3 ft by 5 ft double hung double glass windows. The design indoor air temperature will be taken as 70 F and the design outdoor air temperature as 0 F; for simplicity, any variation of air temperature within the room will be ignored; no contact of the heating surface with an exterior wall will be considered. Infiltration and exfiltration at the rate of 70 lb per hr of air will be assumed. The thermal conductance of the glass between the room-side surface of the glass and the outdoor air will be taken as 0.62 Btu per hr sq ft F, while the thermal conductance of the remainder of the exterior wall between the room-side surface and the outdoor air will be assumed to be 0.15 Btu.

Warm Air Heating — First, assume the room is heated by supplying heated air at low velocities; assume the room surfaces are divided into exterior wall or glass, W, and the other room surfaces, S. The average thermal conductance of the exterior wall and glass is

$C_W = [0.62(30) + 0.15(90)]/120$
$= 0.2675$ Btu per hr sq ft F

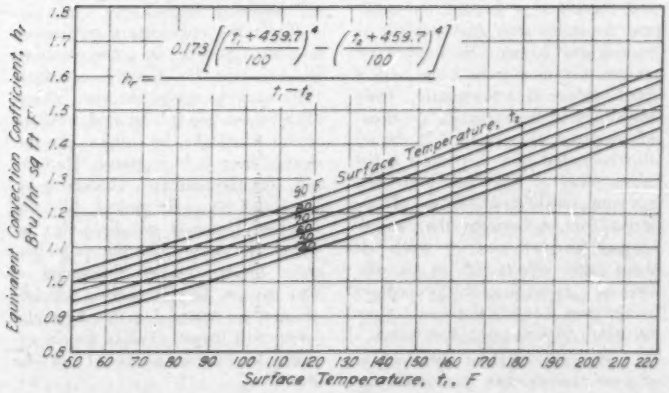
Assume that the surface coefficient by convection for the room-side surface of W is $h_W = 0.5$ and for the room-side surface of S is $h_S = 0.4$ (these values should be checked after t_W and t_S have been found). The equivalent surface coefficient of heat transfer by radiation will be assumed to be $h_r = 1.0$ Btu per hr sq ft F. In thermal equilibrium without storage, the energy balance on W is

$$\underset{\text{[convection]}}{0.5\ A_W\ (t_W - 70)} + \underset{\text{[radiation]}}{A_W\ (t_W - t_S)} + \underset{\text{[conduction]}}{0.2675\ A_W\ (t_W - 0)} = 0$$

Similarly, the energy balance on S is

$$\underset{\text{[convection]}}{0.4A_S\ (t_S - 70)} + \underset{\text{[radiation]}}{A_S F_{S,W}\ (t_S - t_W)} = 0$$

FIG. 1—RADIATION COEFFICIENT of heat transfer



The angle factor from room surfaces other than exterior wall and glass to exterior wall and glass is, from the theorem of reciprocity,

$F_{SW} = (A_W F_{WS}/A_S)$
$= [120(1)]/672 = 0.1786$

The solution of these equations is $t_S = 66.0$ F and $t_W = 57.2$ F; the corresponding rate of heat loss from the structure by transmission is

$q = 120\ (0.2675)\ (57.2 - 0)$
$= 1835$ Btu per hr

The rate of heat loss due to infiltration is

$q = 70\ (0.24)\ (70 - 0)$
$= 1176$ Btu per hr

The rate of heat loss due to transmission and infiltration is 3011 Btu per hr.

The average room-side surface coefficient of heat transfer by combined radiation and convection for the exterior wall (and glass) is

$$h = 1835/120\ (70 - 57.2)$$
$$= 1.2 \text{ Btu per hr sq ft F}$$

Floor Panel Heating — In this case, the same room is heated by a floor panel using the entire floor area; in writing the energy balances, the room surfaces are divided into exterior wall and glass, W, other unheated room surfaces, S, and floor panel p. The various surface coefficients of heat transfer by convection are assumed to be $h_W = 0.45$, $h_S = 0.32$ and $h_p = 0.7$ Btu per hr sq ft F. (These should be checked after t_W, t_S and t_p are found).

The energy balances are:

$0.45\ A_w\ (t_w - 70) + A_w\ F_{w,p}\ (t_w - t_p) + A_w\ (1 - F_{w,p})\ (t_w - t_s) + 0.2675\ A_w\ (t_w - 0) = 0$ (on exterior wall and glass)

$0.32\ A_s\ (t_s - 70) + A_s\ F_{s,p}\ (t_s - t_p) + A_s\ F_{s,w}\ (t_s - t_w) = 0$ (on other unheated surfaces)

$0.32\ A_s\ (t_s - 70) + 0.45\ A_w\ (t_w - 70) + 0.7\ A_p\ (t_p - 70) = 70\ (0.24)\ (70)$ (on infiltering air)

For this room, $F_{w,p} = 0.271$; $F_{s,p} = 0.300$; and $F_{s,w} = 0.178$

The solution is $t_s = 72.0$ F, $t_w = 61.6$ F, $t_p = 80.4$ F; the corresponding rate of heat loss from the structure by transmission is 1977 Btu per hr; the rate of heat loss due to transmission and infiltration is 3153 Btu per hr and the average room-side surface coefficient of heat transfer by combined radiation and convection for the exterior wall (and glass) is 2.0 Btu per hr sq ft F.

Direct Heating with Radiator — Third, assume that the room is heated by 14 sq ft of surface located so that 45 percent of the energy radiated from this surface is absorbed by the exterior wall and the remainder by the other room surfaces. This might be the case with a radiator placed near the exterior wall. The radiator surface will be designated by the subscript d, the exterior wall by W and other room surfaces by S. The various surface coefficients of heat transfer by convection are assumed to be $h_d = 0.9$, $h_W = 0.42$ and $h_S = 0.3$ Btu per hr sq ft F. The equivalent surface coefficient of heat transfer by radiation will be assumed to be 1.4 Btu per hr sq ft F for radiant energy exchange between the radiator and other surfaces, but a value of 1.0 will be assumed for this equivalent coefficient when the radiant energy exchange is between other room surfaces at lower temperatures. The energy balances are:

$0.42\ A_W\ (t_W - 70) + A_W\ F_{W,s}\ (t_W - t_s) + 1.4\ A_W\ F_{W,d}\ (t_W - t_d) + 0.2675\ A_W\ (t_W - 0) = 0$ (on exterior wall and glass)

$0.3\ A_S\ (t_S - 70) + 1.4\ A_S\ F_{S,d}\ (t_S - t_d) + A_S\ F_{S,W}\ (t_S - t_W) = 0$ (on other unheated surfaces)

$0.3\ A_S\ (t_S - 70) + 0.9\ A_d\ (t_d - 70) + 0.42\ A_W\ (t_W - 70) = 70\ (0.24)\ (70)$ (on infiltering air)

Note that $F_{W,d} = 0.45(14)/120 = 0.0525$

$F_{W,S} = 0.9475$

$F_{S,d} = 0.55\ (14)/672 = 0.01146$

$F_{S,W} = 0.9475\ (120)/672 = 0.1692$

The solution is $t_S = 71.1$ F, $t_W = 64.0$ F, and $t_d = 169.2$ F.

The corresponding rate of heat loss from the structure by transmission is 2054 Btu per hr; the rate of heat loss by transmission and infiltration is 3230 Btu per hr, and the average room-side surface coefficient of heat transfer by combined radiation and convection for the exterior wall (and glass) is 2.9 Btu per hr sq ft F.

A summary of results obtained when the same room is assumed to be heated to the same indoor air temperature with the same outdoor air temperature by three different methods is shown as Table 1.

TABLE 1—SUMMARY of results

Heating method	Rate of heat loss by transmission, Btu/hr	Rate of heat loss by infiltration, Btu/hr	Total rate of heat loss, Btu/hr	Equivalent room-side combined surface coefficient, Btu/hr sq ft F
Warm air	1835	1176	3011	1.2
Floor panel	1977	1176	3153	2.0
Direct radiation	2054	1176	3230	2.9

From theoretical reasoning based upon writing energy balances on the room surfaces, it has now been shown by examples that the rate of heat transmission through the structure depends upon the method of heating used to maintain a given air temperature in a given room with a fixed outdoor air temperature. Only basic laws of heat transfer are needed to prove this point. It should also be noted that this effect exists *independent* of any floor to ceiling air temperature gradient and of any direct contact between the heating element and an exterior wall. If these latter effects are to be considered, experimental procedures rather than theoretical reasoning are necessary to determine heat losses.

It must also be clear that the laws of heat transfer are incorrectly applied to the estimate of heat loss when no adjustment of the room-side surface coefficient of combined heat transfer is made for the type of heating used.

[To be concluded]

INCREASE PRODUCTIVE POWER: HOOVER

HERBERT HOOVER declared last month that the "one road to rapid recovery of the nation from our present burden of armament . . . is to increase our productive power by new technologies and new inventions."

Mr. Hoover addressed more than 400 guests — among them four Nobel prize winners — at a dinner at which a $22,150,000 fund raising campaign was launched for the new Columbia University "engineering center" in New York City.

A site for the new center has been acquired. The main 14 story structure is expected to be built in time for Columbia's bicentennial anniversary in 1954.

In his introductory remarks, Mr. Hoover mentioned that he was once a non-resident engineering professor at Columbia University, and gave a course of lectures "that had all the wit of calculus, the humor of a trilobite and the joyousness of thermodynamics. Somebody remembered it about 10 years later and paid me with an honorary degree. That entitles me to be on alumni lists for solicitation of funds."

While the engineering profession has many satisfactions, the engineer has his woes, Mr. Hoover remarked. "His work is out in the open where all men can see it," he said. "If he makes a mistake, he cannot, like the doctor, bury it in a grave. He cannot, like the architect, obscure it by trees and ivy. He cannot, like the lawyers, blame it on the judge or jury. He cannot, like the politician, claim his constituents demanded it. Nor can he, like the public official, change the name of it and hope the voters will forget. Unlike the clergyman, he cannot blame it on the devil."

QUESTION of the Month

If you don't have the answer to one of your problems, maybe someone else does. That's the purpose of this "idea exchange" in each issue.

QUESTIONS ON heating, piping and air conditioning asked by HPAC's readers are answered here each month. We know you'll find these practical comments of interest and value, and we hope you will contribute either a question, or an answer to a published question, for next month's issue. We'll be glad to hear from you. Just address the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

HOW TO PAINT A STEEL STACK

AFTER READING THE Question of the Month about stack painting troubles in the October HPAC, I felt that I might be able to offer several helpful suggestions.

The stack in question was shop primed and painted with a heat resistant paint after erection. A few weeks later, after the stack had been in operation, peeling resulted. This peeling was obviously due to the under coat or prime coat blistering. Most shop prime coats are not heat resistant and would, therefore, cause failure of the top coat.

This stack was scraped, removing the peeling and blistered paint, and then repainted using another manufacturer's heat resistant paint. Several weeks later, rust again began to break through the paint. Undoubtedly, the primer that had been left on the stack blistered or was burned away and was partially the cause of this second failure. Later, when the surface was cleaned to bare steel, paint held better than when primer was present.

Since this stack does not operate above 600 F and the flashing skirt operates at well below this figure, it is not surprising that paint held on the skirt longer than on the stack.

In order to obtain a lasting paint job on an exposed metal stack, it is necessary to remove all mill scale, rust, dirt, oil and moisture. This cleaning can be done most effectively by sandblasting. The stack should be painted immediately after cleaning to prevent rusting and the accumulation of moisture. It is customary to apply two coats of heat resistant paint. This is necessary to prevent the penetration of moisture through the paint film during shutdown periods. Thermal shock due to the contact of moisture or rain on the surface of the operating stack is often the primary cause of premature paint failure. To prevent this premature failure, the stack paint must maintain adhesion, flexibility and prevent moisture penetration. There are many heat resistant paints on the market today that fulfill the above requirements.—S.L.R.

ALLOW TO WEATHER BEFORE PAINTING

REGARDING F. B. M.'s problem on painting a steel stack, as outlined in the October issue, I have made it a practice to allow a period of three months at least for any steel work to weather before any paint is applied, because of the fact that it is useless to paint over mill scale. I wonder if this may not be F. B. M.'s trouble; it may be that a combination of weather and fabrication had done a fair job of removing mill scale from the skirt, and actual hard labor removed most of it from the patch; however, the elements can do the best job of removing scale and do it cheaply.

I don't think the flue gas temperature could be very high burning mill waste, and therefore the trouble would not be found in the paint's inability to withstand the temperature.—F.W.B.

HEATING TURKISH AND RUSSIAN BATHS

WITH REFERENCE TO the question from A. T. F. in the September HPAC regarding heating Russian and Turkish baths, the following information may assist him.

The Russian bath is usually incorporated in the Turkish bath premises, and consists simply of a room containing saturated vapor and maintained at a temperature of 100 to 110 F with steam at low pressure discharging into the room from suitable nozzles or perforated copper tubes located under the seats. Shields or baffles are necessary to prevent impingement of steam on the occupants. Natural air vents exhausting from low level through ducts to high level discharge to atmosphere are usually provided.

The construction of the room calls for adequate insulation and impervious internal surfaces, drainage, and close-fitting double glazed doors.

Thermostatic control is advised, together with control valves for either operation by the occupants or under the supervision of an attendant.

The Turkish bath is, of course, a warm air bath and consists of a series of rooms maintained at different air temperatures.

The *Frigidarium* generally applies to the areas occupied by the locker room, cooling lounge, shampoo room and toilets, and is maintained at normal temperature (70 to 75 F).

The *Tepidarium* is the first hot room, with a maintained temperature of 140 to 160 F.

The *Calidarium* is the second hot room, with a maintained temperature of 160 to 180 F.

The *Laconicum* is the hottest room, with a maintained temperature of 200 to 230 F.

The shampoo room is equipped with massage slabs, needle shower baths, spray showers and foot baths.

When the baths are not situated adjacent to a swimming pool, the premises usually have a plunge bath with a depth of 3 ft to 4 ft, 6 in.

Ventilation throughout should be based on four to five air changes per hour. A convenient system consists of a warm air plant handling all outdoor air, and incorporating the usual dampers, air filters, fan and heater, with ducts serving the various rooms.

A suitable arrangement would be to concentrate all the equipment in one area, from which the ducts could

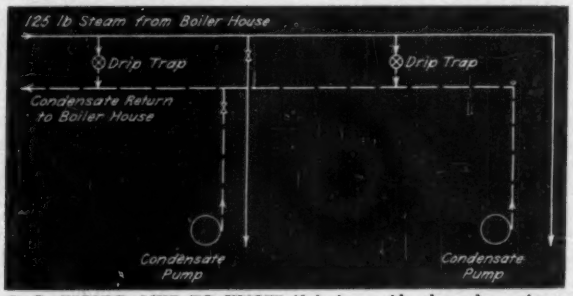
IS IT GOOD PRACTICE TO CONNECT DISCHARGE FROM DRIP TRAPS THIS WAY?

You are invited to answer the following question from a consulting engineer. Please address your reply to the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

"I wonder if HPAC's readers can tell me if it is good practice to connect the discharge from drip traps on a 125 lb steam main directly to a low pressure condensate return main located underground adjacent to the steam main?

"The low pressure condensate return will be operated at a pressure of from 20 to 30 lb and will be fed by condensate return pumps located in various buildings served by a central heating system.

"The accompanying sketch illustrates the connection which is intended to be used."—G.B.



G. B. WOULD LIKE TO KNOW if it is considered good practice to connect the discharge from drip traps in this manner

be run to serve the laconicum first, then the calidarium, and then the tepidarium, so as to secure a progressive drop in temperature. Alternatively, the ducts could be arranged for the main heater to supply the initial heat for ventilation of the frigidarium, with booster heaters in the ducts for the respective hot rooms.

The air inlets to the rooms should be at a high level on one side, and fitted with a means for adjustment for correct air quantities. Natural air vents exhaust at low level from under the seats on the opposite side of the room through ducts discharging to atmosphere at high level.

Thermostatic control is advised.

The hot water storage heaters should be thermostatically controlled to maintain a temperature of 110 F maximum. A higher temperature could be used if suitable thermostatic mixing valves or blenders were fitted to the needle shower baths, spray showers, and foot baths.

Provision must be made for maintaining the temperature and circulation of the water in the plunge bath, together with arrangements for purification or sterilizing, such as chlorination or ultraviolet treatment, etc., to avoid excessive water change and to maintain heat economy.

The hot rooms are usually constructed with well insulated walls and surfaces suitable for the temperatures.

The sizes of the rooms and the equipment naturally depend upon requirements but the size ratio of the individual rooms could be varied in relation to the temperature, as it is obvious that the extent and period of occupation is progressively smaller from the tepidarium to the laconicum. —T.E. de V.

SUGGESTS DIRECT HEATERS FOR TURKISH BATHS

THIS IS IN reply to the Question of the Month from A.T.F., which was published in the September HPAC.

Turkish baths require dry air at temperatures well above the boiling point of water at atmospheric pressure. At least four air changes per hour are considered necessary. Of the various methods for heating the air, direct gas fired heaters have many advantages. The bath is then independent of other heat services in the building, long runs of piping are avoided, there is no need for high steam pressures on the main plant and temperature and ventilation control are simplified.

Typical data from practice in England are:

Air temperature required at heater outlet ..... 350 to 400 F.
Air changes ..... 4 per hr.
Hot rooms (approximate dimensions and temperatures)—
Laconicum—200 F. 18 ft x 10 ft x 9 ft high.
Calidarium—160 F. 18 ft x 17 ft x 9 ft high.
Tepidarium—125 F. 18 ft x 20 ft x 9 ft high.
Total cube of hot rooms: say 7000 cu ft.
Gas consumption: 2.0 to 2.5 therms per hr.

The air supply must, of course, be clean and the hot rooms well insulated against heat loss.

Either one large air heater, or individual heaters with separate ducts for each room, can be used. With the one central heater, air is passed from one room to the next. Expansion and natural cooling is generally sufficient to give the required temperature differences, but the ducts should be designed so that additional air direct from the heater can be passed direct into the second hot room should it be found necessary.

Russian — or vapor — bath installations require only a small boiler, of the order of 50 to 60 lb per hr of steam. The usual suite has a dressing room, steam room, bathing room and rest room. The steam room normally has an area of 200 to 300 sq ft and is about 10 ft high, with three tiers of seats. Steam is admitted through a perforated pipe at 5 psi below the lowest tier, and produces a range of temperature between about 120 F at the top tier to 100 F at the bottom.

Further information, with examples of actual installations, may be found in a paper given before the Institution of Heating and Ventilating Engineers (London) and published in Vol. XXX, 1931/32, of the IHVE *Proceedings*.—W.F.M.

BOILER NUMBERS MADE LEGIBLE

CORROSION HAD obliterated the identification numbers on a boiler shell. The boiler was known to have the identification on it, but as it was illegible the licensing authorities were unable to start their inspection.

Sam Tour & Co., Inc., consulting engineers and metallurgists, removed the boiler insulation from around the area where the numbers were thought to exist. The area was cleaned, and then given an acid etching treatment. The numbers thus became legible, and the problem was solved.

The Law and Your Profits

Arbitration Clauses

RELIANCE UPON arbitration clauses is not always justified, nor do such provisions in a contract serve to prevent its cancellation. On the contrary, an arbitration clause may be invoked for the benefit of the cancelling party, as a heating and piping firm in the east found recently.

The Generality Construction Co. let contracts to Centigrade & Fahrenheit (all names imaginary) for the heating and piping work on two large building projects. Each contract contained this clause: "Any controversy or claim arising out of or relative to this contract or any breach thereof shall be settled by arbitration."

Work progressed for about nine months after the contracts were signed, with no apparent friction between the parties. The buildings were nearing completion and Generality owed C. & F. a substantial unpaid balance on the jobs. Nevertheless, the relationship was getting out of joint. Suddenly (and without justification, C. & F. claimed) Generality Construction Co. terminated the contracts, presumably leaving the C. & F. firm under obligations to its suppliers and subcontractors.

The excuses that Generality gave for the cancellation were lacking in good faith, Centigrade & Fahrenheit claimed. The latter alleged that it was misled into continuing the investment of labor and materials in the projects after Generality had secretly decided to dump C. & F. so as to have the work finished by other parties — if possible, at less cost.

As things turned out, Generality Construction Co. appears to have saved nothing by making the switch; on the contrary it paid more to have the heating and piping work finished than if it had stuck to Centigrade & Fahrenheit.

Generality tore up its contracts with C. & F. in April. C. & F. waited until the middle of July, when it

commenced suit against Generality and others for damages resulting from alleged fraud. Generality then asked the judge for a stay of proceedings on the ground that all points in the suit were referable to arbitration under the contracts. Before the court rendered a decision on this request, C. & F. amended its complaint and based it on the termination of contracts containing arbitration clauses. C. & F. said to the judge, in effect:

"All right, Your Honor; we'll stand on the very point that the construction company has brought up. Of course the contracts carry arbitration clauses, and that furnishes a conclusive reason why Generality should have arbitrated any and all differences instead of calling everything off."

The construction company thereupon withdrew its motion in this court and started "special proceedings" in another court to compel arbitration. C. & F. lost no time, and obtained from the second court an order to consolidate (a) the "special proceeding" to compel arbitration, with (b) C. & F.'s "action" in the first court based on the "recision" of the contracts.

Generality Construction Co. appealed. The appellate division of the state supreme court reversed the lower court's decision and refused to permit consolidation of Generality's "proceedings" (to compel arbitration) with C. & F.'s "action" in respect to the contracts' abrupt ending.

A consolidation of the two cases, reasoned the higher court, would deprive the construction company of its rights to an immediate trial of the preliminary issue of fraud in the *making* of contracts that could be arbitrated. This issue, said the appellate tribunal, "would have to be tried first, and consolidation would be improper."

There's a Lesson from Decision

Although final disposal of C. & F.'s "action" against the construction company or that corporation's "special proceedings" respecting arbitration has not been announced at this writing, there's a lesson from what has already been decided. An arbitration clause in a contract is no sure-fire protection against a presumably unjust cancellation of a contract by the other party. This is because (in some states, at least) a complaint based on cancellation is one kind of a case and any proceedings having to do with arbitration are in an entirely different legal area. The two can't be considered at the same time. Either the complainant may find that he has no contract to arbitrate; or that the arbitration, if held, does him no good by reason of being entirely separated from the injury inflicted through the contract's cancellation.

[Note: While this discussion applies to an actual case, it must be remembered that legal rules vary in different states.]

William Hurd Hillyer, author of this article, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., his work there gave him a practical legal background.

Sam Lewis Page

. . . . . pertinent comment on practical problems

• INFORMAL COMMENT on heating, piping and air conditioning matters is given in this regular feature by Samuel R. Lewis, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors.

"THESE BE BUSY DAYS"

IT IS EASY AND comfortable to sit at my desk and to design complicated air ducts. However, I get interrupted at least every 15 minutes by telephones and callers or by some imperious client who wants to know, Where are those drawings that Harry promised? So I rush to Harry's desk and find that Harry is out for coffee in mid-morning. My collar commences to get hot so that I yell for Tom. Tom, who might know something about Harry's job, is out for coffee too. I plead with Dick, but Dick is busy on something else and so I have to do the job myself.

All this is inspired by a recent issue of the Scientific American that contains a series of articles by captains of research and education. The captains discuss the supply and efficiency of United States manpower and womanpower. It appears that we are very short on engineers. We are also short on stenographic help and may expect that the situation will get worse. Then comes my auditor with the income tax computation for the month and the news that I have been making so much money that I must pay so much money that I haven't any money left to pay more salaries to my staff so that we all may earn more money to pay more income tax money!

The answer of course is just to keep on taking care of clients — admitting that the client is always right — and to work at least 56 hours a week to support the 40 hour per week employees. Ultimately, I suppose, the top of inflation of the dollar will be reached, all engineers who work for other engineers for wages will go into the engineering business for themselves, and all stenographers and typists will be happily married.

Perhaps wars and the fears of war are inflicted upon us so as to make us go back to work in an approach to the Biblical six days (and a few nights) every week.

There are compensations to a busy life, though. For example, it really is fun to have a brass-hat executive of a husky corporation say to me (as he did this morning): "This plant that you have designed costs much more than we had hoped, but we retained you as a trustworthy person and we must take your advice and so please get the contractors started". In this particular instance, I am recommending that one new boiler burn coal, while the other new boiler should burn oil — though either boiler alone can do the job. The reasons are obvious to anyone who administered any part of the fuel rationing program during World War II.

In another case, in a large hotel, they have pulled along for many years with one boiler only, burning coal with a stoker. There were two idle, older, smaller boilers capable of being fired manually with coal and together able to do the work of the stoker fired boiler. The owner wished me to recommend replacing the stoker with an oil burner. I declined, but recommended installing oil burners in the two perfectly good older boilers, leaving the stoker and its boiler alone. They would thus be able to use whichever fuel may be available. This owner also followed my advice and the burners went in.

In rehabilitation projects like these, the need appears for rather ruthless ripping out of obsolete pipes, valves and other appliances. In one large printing plant recently corrected, I found evidence of "historical timidity."

The first big brickset boiler had adequate steam and return connections to the original 50 year old gravity circulating steam heating system. The 20 year old addition to the building was heated by a second duplicate boiler with radiator traps and blast coil traps and an electric vacuum pump.

Someone was afraid to connect the old system to the new one in a logical way, but the fireman learned that during most of the time the younger boiler could furnish steam to the entire plant. He therefore achieved a connection between the steam mains of both systems on the radiator sides of each original boiler stop valve and made the younger boiler accept the gravity returns from the older building at the same time it received the pumped-in returns from the vacuum heated building.

To add to the pleasure, someone connected the heat transfer coil in the domestic and process hot water heater with each boiler on the boiler side of each original boiler stop valve. This of course bypassed the main stop valves. The younger boiler had a stoker but the patriarch was manually fired.

I required the construction of properly balanced and valved steam and return headers connecting the boilers, a main float trap and good air valves on the heating system of the older building, and arranged the electric vacuum pump to feed either or both boilers. The dangerous duplicate bypass to the hot water heater was deleted and hundreds of pounds of obsolete fittings and valves were removed.

Let it be desired and published that unused obsolete mechanical equipment — all the way from toilet fixtures to gas jets to electric control panels to steam fittings — should be removed right then, and not left to obstruct future justice!

Threshold Limit Values for 1951

DATA sheet

Adopted at the meeting of the American Conference of Governmental Industrial Hygienists, at Atlantic City, N.J., April 1951, and reprinted by permission from the American Medical Association's Archives of Industrial Hygiene and Occupational Medicine. The ACGIH committee comprised K. C. Charron, K. E. Markuson, Arthur Vorwald and W. G. Frederick

GASES AND VAPORS

SUBSTANCE	PPM
Acetaldehyde	200
Acetic acid	10
Acetic anhydride	5
Acetone	500
Acrolein	0.5
Acrylonitrile	20
Ammonia	100
Amyl acetate	200
Isoamyl alcohol	100
Aniline	5
Arsine	0.05
Benzene (benzol)	35
Bromine	1
1,3-Butadiene	1,000
n-Butanol	100
2-Butanone	250
n-Butyl acetate	200
Butyl cellosolve® (2-butoxyethanol)	200
Carbon dioxide	5,000
Carbon disulfide	20
Carbon monoxide	100
Carbon tetrachloride	50
Cellosolve® (2-ethoxyethanol)	200
Cellosolve® acetate	100
Chlorine	1
2-Chlorobutadiene	25
Chloroform	100
1-Chloro-1-nitropropane	20
Cyclohexane	400
Cyclohexanol	100
Cyclohexanone	100
Cyclohexene	400
Cyclopropane (propene)	400
o-Dichlorobenzene	50
Dichlorodifluoromethane	1,000
1,1-Dichloroethane	100
1,2-Dichloroethane (ethylene dichloride)	75
1,2-Dichloroethylene	200
Dichloroethyl ether	15
Dichloromethane	500
Dichloromonofluoromethane	1,000
1,1-Dichloro-1-nitroethane	10
1,2-Dichloropropane (propylene dichloride)	75
Dichlorotetrafluoroethane	1,000
Dimethylaniline	5
Dimethylsulfate	1
Dioxane	100
Ethyl acetate	400
Ethyl alcohol	1,000
Ethyl benzene	200
Ethyl bromide	200
Ethyl chloride	1,000
Ethylene chlorohydrin	5
Ethylene oxide	100
Ethyl ether	400
Ethyl formate	100
Ethyl silicate	100
Formaldehyde	5
Gasoline	500
Heptane	500
Hexane	500
Hydrogen chloride	5
Hydrogen cyanide	10

SUBSTANCE	PPM
Hydrogen fluoride	3
Hydrogen selenide	0.05
Hydrogen sulfide	20
Iodine	1
Isophorone	25
Mesityl oxide	50
Methanol	200
Methyl acetate	200
Methyl bromide	20
Methyl butanone	100
Methyl cellosolve® (2-methoxy-ethanol)	25
Methyl cellosolve® acetate	25
Methyl chloride	100
Methylcyclohexane	500
Methylcyclohexanol	100
Methylcyclohexanone	100
Methyl formate	100
Methyl iso-butyl ketone	100
Chlorobenzene	75
Fluorotrichloromethane	1,000
Nitrotoluene	5
Naphtha (coal tar)	200
Naphtha (petroleum)	500
Nickel carbonyl	1
Nitrobenzene	1
Nitroethane	100

SUBSTANCE	PPM
Nitrogen oxides (other than N_2O)	25
Nitroglycerin	0.5
Nitromethane	100
2-Nitropropane	50
Octane	500
Ozone	1
Pentane	1,000
Pentanone (methyl propanone)	200
Phosgene	1
Phosphine	0.05
Phosphorus trichloride	0.5
Isopropyl alcohol	400
Propyl acetate	200
Isopropyl ether	500
Stibine	0.1
Stoddard solvent	500
Styrene monomer	200
Sulfur chloride	1
Sulfur dioxide	10
1,1,2,2-Tetrachloroethane	5
Tetrachloroethylene	100
Toluene	200
Toluidine	5
Trichloroethylene	100
Turpentine	100
Vinyl chloride	500
Xylene	200

TOXIC DUST, FUMES, AND MISTS

SUBSTANCE	MIL. PER CU. M.
Antimony	0.5
Arsenic	0.5
Barium	0.5
Cadmium	0.1
Chlorodiphenyl	1
Chromic acid and chromates as CrO_3	0.1
Cyanide as CN	5
Dinitrotoluene	1.5
o-Dinitrocresol	0.2
Fluoride	2.5
Iron oxide fume	15
Lead	0.15
Magnesium oxide fume	15
Manganese	6

SUBSTANCE	MG. PER CU. M.
Mercury	0.1
Pentachloronaphthalene	0.5
Pentachlorophenol	0.5
Phosphorus (yellow)	0.1
Phosphorus pentachloride	1
Phosphorus pentasulfide	1
Selenium, as Se	0.1
Sulfuric acid	1.0
Tellurium	0.1
Tetryl	1.5
Trichloronaphthalene	5
Trinitrotoluene	1.5
Zinc oxide fume	15

MINERAL DUSTS

SUBSTANCE	MPPCF
Alundum	50
Asbestos	5
Carborundum	50
Dust (nuisance, no free silica)	50
Mica (below 5% free silica)	20
Portland cement	50
Talc	20

SUBSTANCE	MPPCF
Silica	
high (above 50% free SiO_2)	5
medium (5 to 50% free SiO_2)	20
low (below 5% free SiO_2)	50
Slate (below 5% free SiO_2)	50
Soapstone (below 5% free SiO_2)	20
Total dust (below 5% free SiO_2)	50

RADIATIONS

MATERIAL OR RADIATION	
Gamma (roentgens per week)	0.3
Radon (curies per cubic meter)	10^{-8}
Thoron (curies per cubic meter)	10^{-8}
Roentgen (roentgens per week)	0.3

MATERIAL OR RADIATION	
Radium 226 (microcuries per cubic meter)	10^{-6}
Polonium 210 (microcuries per cubic meter)	10^{-6}

Heating, Piping & Air Conditioning

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

JOURNAL SECTION

Gas is an Important Factor in the Thermal Conductivity of Most Insulating Materials‡

By F. B. Rowley*, R. C. Jordan**, C. E. Lund†, and R. M. Lander††, Minneapolis, Minn.

SUMMARY—Conductivity of insulating materials is affected by the quantity of air or gas contained. This report describes special hot plate apparatus enclosed in a sealed chamber from which the air and gases could be exhausted. The results show the effect of the removal of gas upon the conductivity of various types of materials.

THERE ARE many conditions and factors which affect the thermal conductivity of insulating materials. Some of these are within the materials themselves, some are the result of conditions under which heat transfer takes place, and others are within the mechanism by which heat is transferred through the material. Some of the factors inherent in the material are structure, density and moisture content. Some of those which may be attributed to conditions under which heat is transferred are mean temperature and in some cases orientation of test sample. Most changes which affect the overall rate of heat transfer through the sample will also disturb the relationship between the amounts given off by radiation, convection or conduction. An analysis of the effect on the thermal conductivity of a given material caused by changing any one of the foregoing factors may thus become very complicated. For instance, increasing the density of a material may either increase or decrease its thermal conductivity, depending upon the structure of the material and the range over which the density is changed. The moisture content will have a greater effect on the thermal conductivity of some materials than on others. Likewise, the orientation of a sample, that is, the direction of heat flow through the sample, may have a major effect on some samples while on others there may be no effect whatsoever.

As is well known, heat is transferred through most insulating materials by a combination of conduction, convection and radiation. Any changes in the structure, density or moisture content of the sample or variation of test conditions will usually affect differently the rates of heat transfer by the various methods. The overall effect may be one of increasing or decreasing the conductivity, but it does not show any basic reason for the change.

The results of most researches relating to the variations in thermal conductivity, caused by changing those factors which may be considered as within the material itself, or which may be caused by the setup of test conditions, have been evaluated on the basis of their overall effect on the thermal conductivity of a given type of material. Sufficient data have not been available to determine the effect of these changes on radiation, convection, and conduction, which go to make up the total heat flow. For instance, many investigations to determine the effect of density on the thermal conductivity of a given type of material have been made on the basis of its effect on the overall thermal conductivity without

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attempting to determine what part of the heat flow mechanism was affected by the change in density.

The purpose of this program was to set up test conditions and to provide apparatus by which that portion of the heat transferred by any gas within the sample could be eliminated, or at least controlled, and thus permit a more complete analysis of the conductivity of insulating materials as affected by some of the factors enumerated.

Method Used

The statement that heat is transferred through an insulating material by radiation, convection, and conduction, is based on the assumptions that this material has some open spaces between the solid structure and that these openings are filled with gas which will transfer some of the heat that would not be passed through if the gas were entirely eliminated from the space. While this portion of the heat is often classed as convected heat, in most cases the greater portion of it is transferred by conduction through the gas, and convection is a minor factor. In order to avoid confusion, the term *gas transferred heat* will be used in this paper to designate the total heat transferred by the gas within the sample. Since it is not possible to evacuate all of the gas from the cells within the sample, the studies must be confined to a reduction of the gas pressure to the lowest possible value.

Apparatus for determining the thermal conductivity of materials under atmospheric conditions has been developed and standardized at the University of Minnesota and at other laboratories. In addition, some work has been done at the University of Minnesota to obtain the heat output from radiating surfaces when they were placed in a vacuum chamber. In the present study it was proposed to install the most practical refined thermal conductivity apparatus in a vacuum chamber in which the pressures could be reduced to a magnitude of 0.1 microns of mercury and also in which the temperature could be reduced to −65 F. With this apparatus it would be possible to reduce to a minimum the gas transferred heat and with the comparative results, to evaluate this portion of the heat transferred as a factor in heat transfer through various types of materials.

Description of Apparatus

The test apparatus as designed and built is shown in Figs. 1 to 5. Fig. 1 shows the assembled apparatus in position for the test. This shows the exterior of the steel vacuum chamber, *A*, which encloses the test plate shown in Figs. 2, 3, and 4. On the framework above the vacuum chamber is an electrical hoisting apparatus used for handling the vacuum chamber. Underneath the table is shown an oil and mechanical pump. At the left on the wall is a vacuum gage

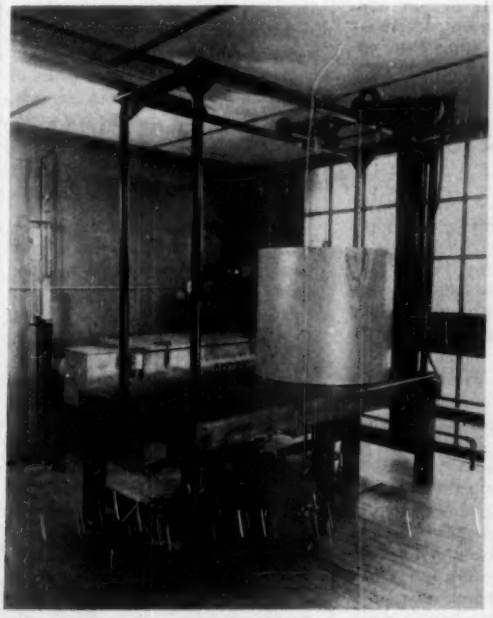

Fig. 1—Apparatus assembled in position for test showing exterior of steel vacuum chamber *A*

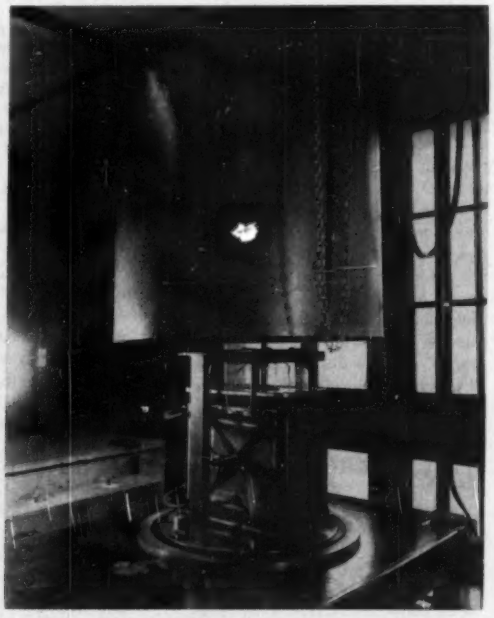

Fig. 2—Vacuum bell chamber in elevated position with hot plate apparatus below

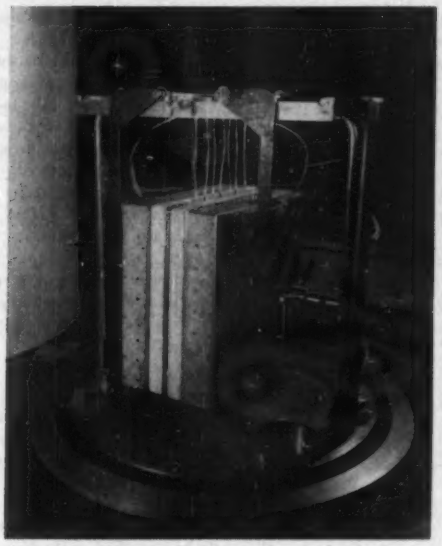

Fig. 3—Thermal conductivity apparatus with insulating surfaces removed, and showing test specimens clamped between heating and cooling plates

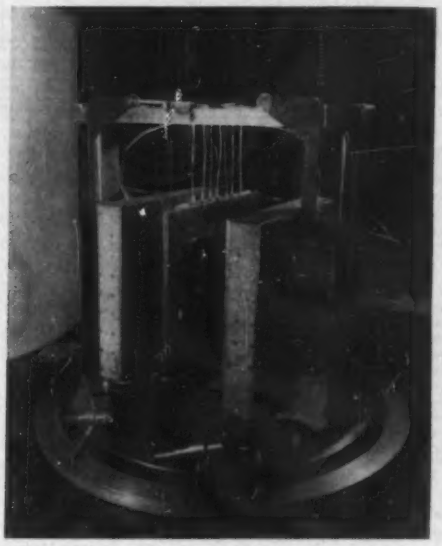

Fig. 4—Cooling plates separated from central heating plate with test specimens removed

and directly back of the table is shown the low temperature alcohol tank which supplies the cooled liquid for the cold plates of the test apparatus within the vacuum chamber. The 5 hp refrigerating unit, not shown in these illustrations, is capable of reducing the temperatures to −65 F.

Fig. 2 shows the vacuum bell chamber in an elevated position with the hot plate test apparatus underneath. As indicated in Fig. 5, the vacuum bell is heavily insulated. The rubber gasket used to seal the joints between the bell and the base is readily discernible around the steel base. All of the connections for the electrical heating elements, thermocouples, cooling liquids for the cold plates, and the vacuum connection from the chamber to the pump are carried through the base of the vacuum chamber by means of tightly sealed connections.

Fig. 3 shows the thermal conductivity apparatus proper, with the edge insulating surfaces removed and with test specimens clamped between the heating and cooling plates.

Fig. 4 shows the cooling plates separated from the central heating plate and with test specimens removed. As will be noted, the central or heating plate has been designed as a rather thin structure to give low heat capacity. It has been suspended by wires from the upper frame to prevent, as far as possible, any leaks of heat to the base or surrounding parts of the structure. The plate is designed for 12-in. square test specimens. The actual test area is 8 in. square with a 2-in. guard area around the outside edge of the test specimen.

Fig. 5 shows a diagrammatic view of the section of the apparatus. Detailed drawings were too complicated to include in this discussion. While the thermal conductivity apparatus is designed and built on the same principles as previously developed in this laboratory, some changes and refinements were made to adapt it to the special program.

All of the temperatures, electrical readings, etc., were taken by standard precision instruments. The potentiometer equipment, using copper constantan thermocouples, and the switchboards have not been shown.

Method of Procedure

As previously stated, the prime purpose of this investigation was to study the part played by gases on the overall heat transfer of the material under various conditions. The procedure was to select samples which would be typical of various types of materials and to study the thermal conductivity of the samples with gas within the pores at full atmospheric pressure, with gas within the pores at a reduced atmospheric pressure and with the gas eliminated to the fullest extent of the apparatus. Since it was possible to obtain the desired types of samples from commercial materials, this was done rather than to attempt to make up special non-commercial samples. In most cases, similar materials might have been obtained from other manufacturers' lines; however, this did not seem necessary in order to arrive at the fundamental conclusion.

Test Materials Selected

Due to the fact that the investigation of a single material required a considerable amount of test time,

Table 1—Reduction in Thermal Conductivity Caused by Evacuating the Air from Various Materials

Material	Density lb/cu ft	Thickness Inches	100 F Mean Temperature: Thermal Conductivity, *k* — Atmospheric Pressure	Low Pressure: Microns Hg	Low Pressure: *k*	Percent Reduction
Air space — Copper surfaces		1	0.572[a]	0.07	0.187[a]	67.3
Corkboard	6.67	1	0.283	0.06	0.106	62.5
Corkboard	12.4	1	0.314	0.13	0.120	61.8
Cotton	0.78	1	0.288	0.07	0.072	75.0
Cotton	1.55	1	0.257	0.12	0.052	79.8
Cotton	2.62	1	0.248	0.14	0.033	86.7
Coarse glass wool	2.8	1	0.267	0.04	0.055	79.4
Fine glass wool "A"	0.58	1	0.2505	0.08	0.050	80.0
Fine glass wool "A"	1.94	1	0.2145	0.05	0.0195	90.9
Fine glass wool "A"	3.8	1	0.211	0.11	0.012	94.3
Fine glass wool "B"	0.78	1	0.302	0.04	0.0665	78.0
Hairfelt	11.1	½	0.260	0.10	0.031	88.1
Kapok	0.26	1	0.366	0.10	0.091	75.1
Kapok	0.99	1	0.2445	0.10	0.0375	84.7
Kapok	3.96	1	0.244	0.12	0.0175	92.8
Mineral wool	7.7	1	0.258	0.05	0.037	85.7
Silica Aerogel	8.6	1	0.1715	0.07	0.0255	85.1
Sepecial specimen	3.1	1	0.231	0.09	0.0145	93.7
Wood fiber board	15.5	½	0.353	0.05	0.075	78.8
Wood fiber	3.5	1	0.2715	0.08	0.052	80.8
Wood fiber	6.9	1	0.277	0.09	0.033	88.1

[a]Conductance.

it was necessary to confine the selection to single materials which would be typical of a class. The list of the materials is therefore not as extensive as the authors would have desired, but the results do show interesting comparisons between materials of different types. The materials selected and reported in this discussion were corkboard, cotton, glass wool, hair felt, kapok, mineral wool, silica aerogel, wood fiber, and wood fiber-board. In addition to these, a special test specimen was constructed by using eight sheets of aluminum foil between nine sheets of corrugated paper, the corrugations of alternate layers being at right angles to each other, and some work was done on air spaces bounded by the copper plates of the test apparatus and varying in thickness from ¼ in. to 1 in.

Table 2—Effect of Very Low Gas Pressures on the Thermal Conductivity of Various Materials

Material	100 F Mean Temperature: Thickness Inches	Density lb/cu ft	Pressure Microns Hg	Conductivity *k*
Air space — copper boundary surfaces	1	—	Atm[a]	0.572
			0.10	0.245
			0.07	0.187
			0.0	0.145[b]
Corkboard	1	6.67	Atm[a]	0.283
			0.08	0.121
			0.06	0.106
Cotton	1	0.78	Atm[a]	0.288
			0.11	0.0805
			0.07	0.072
Fine glass wool	1	0.78	Atm[a]	0.302
			0.05	0.0695
			0.04	0.0665
Mineral wool	1	7.7	Atm[a]	0.258
			9.0	0.059
			3.0	0.0425
			0.02	0.037

[a]Atmospheric pressure.
[b]Calculated.

Corkboard and wood fiber-board were oven dried before testing. In the test they were clamped between the plates and the thickness measured as set up for the test. All loose and flexible materials were tested on the *as received* basis, the proper thicknesses being maintained by wood frames around their edges or by special spacer blocks placed in the corners of the test specimens. In order to get a good test sample, the kapok and loose wood fiber materials were repacked. The other samples were tested on the *as received* basis without repacking.

Discussion of Test Results

The comparison of test results, as given in Table 1 for various materials, for the conditions (1) with air pressures within the material at atmospheric pressure, and (2) with air evacuated to the fullest extent of the apparatus, shows that in all cases a marked reduction in thermal conductivity was caused by evacuating the air from the sample. This reduction, as shown in the last column of the table, varies from 61.8 percent for corkboard to 94.3 percent for one of the glass wool samples. These results emphasize the significance of gas transferred heat in most insulating materials.

In general, the percentage reductions are greater for fibrous materials than they are for the non-fibrous materials. This may be explained by the fact that the fibrous materials tested have a higher percentage of their volumes occupied by air than is the case for cork as tested. Therefore, any changes in the conductivity of the air would have a greater effect on the total conductivity for the fibrous materials

Table 3—Effect of Partial Atmospheric Pressure on the Thermal Conductivity of Various Materials
(100 F Mean Temperature)

Glass Wool — Sample A						Kapok		Glass Wool Sample B		Silica Aerogel	
Density, 16 per cu ft											
0.58		1.94		3.8		0.26		0.78		8.8	
p	*k*	*p*	*k*	*p*	*k*	*p*	*k*	*p*	*k*	*p*	*k*
29.0	0.250	29.1	0.2145	28.8	0.211	29.25	0.358	29.3	0.300	29.05	0.170
19.2	0.249	19.25	0.2145	19.2	0.2105	19.3	0.358	14.35	0.299	18.8	0.157
9.1	0.249	9.3	0.2125	9.1	0.207	9.3	0.358	0.5	0.299	9.0	0.139
0.5	0.245	5.0	0.2115	5.0	0.204	0.5	0.356			4.0	0.126
		0.5	0.1995	0.4	0.180					0.43	0.101

p = pressure, in. Hg.
k = conductivity, Btu per (sq ft) (hr) (F deg per in.).

Table 4—Effect of Partial Atmospheric Pressure on the Thermal Conductance of Air Spaces Bounded by Tarnished Copper
(100 F Mean Temperature)

Width of Air Space, Inches							
0.251		0.511		0.777		0.990	
Press. In. Hg	Cndt. *a*	Press. In. Hg	Cndt. *a*	Press. In. Hg	Cndt. *a*	Press. In. Hg	Cndt. *a*
29.3	0.882	28.85	0.549	29.1	0.566	29.3	0.581
19.3	0.883	19.5	0.518	19.4	0.470	19.8	0.490
8.9	0.882	10.0	0.509	13.85	0.420	10.0	0.375
0.5	0.891	0.5	0.513	9.3	0.394	0.5	0.333
				0.55	0.387		

than it would for the non-fibrous materials. The importance of air volume is also emphasized on a smaller scale by the results for corkboard at different densities. For densities of 6.67 and 12.4 lb per cubic foot, the percentage reductions in conductivity are 62.5 and 61.8, respectively. The percentage reduction indicates the relative importance of the included gas as a factor in the overall heat transmissions through the samples.

The test results are summarized in Tables 1 to 4, inclusive, and in the curves shown in Figs. 6 to 8, inclusive.

It should be noted that the reduction in conductance for the one-inch air space is 67 percent; but if the heat transferred by radiation is subtracted from the conductance, the percent reduction is increased to 90. The special test specimen which was designed for high resistance to radiation gave a reduction of 93.7 percent, thus indicating a very low percentage of radiant heat through the sample and a high percentage of air borne heat.

While the percentage reductions as shown in Table 1 are for the most part very high, they show only the total reductions between the two extremes of pressure as tested, and do not indicate where, along the dropping pressure scale, these reductions may take place. In order to get some data in this area, tests were made on a few of the materials at variable pressures in the very low range and at variable partial atmospheric pressures. The test apparatus is not designed for good control between the ranges of 0.5 in. Hg and 1.0 microns of mercury. Therefore, it was not possible to explore this field.

Effect of Pressure Changes in the Low Ranges

The results of tests on four typical materials plus the one-inch thick air space at variable pressures in the low range are shown in Table 2. While the ranges used are limited, they do show that changes are taking place rapidly in the low range and indicate that perhaps the greater part of the high reductions, as shown in Table 1, do take place at the lower

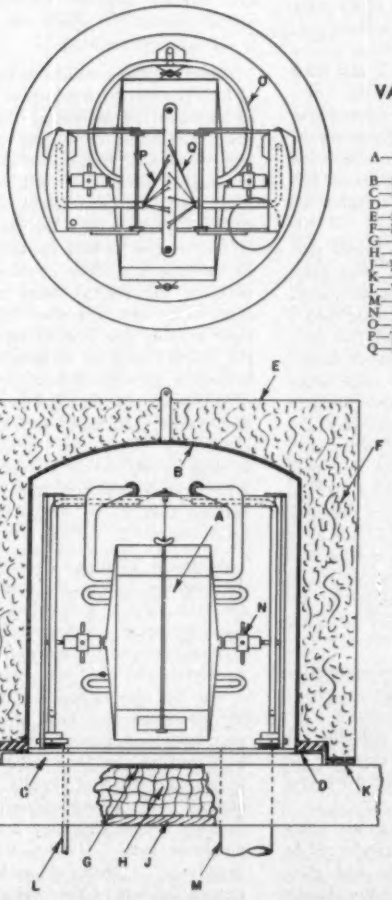

Fig. 5—Diagrammatic view of section of test apparatus

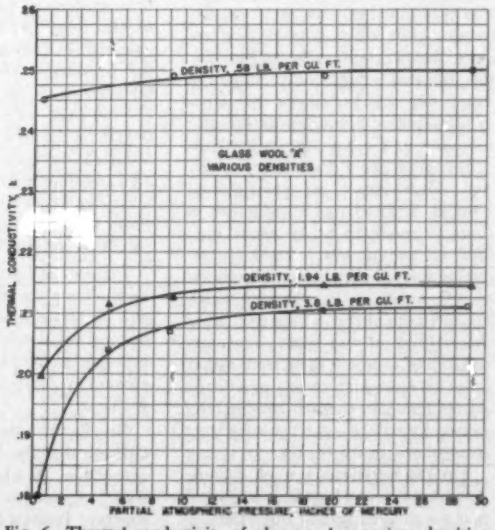
DENSITY, .58 LB. PER CU. FT.
GLASS WOOL "A" VARIOUS DENSITIES
DENSITY, 1.94 LB. PER CU. FT.
DENSITY, 3.8 LB. PER CU. FT.
THERMAL CONDUCTIVITY, k
PARTIAL ATMOSPHERIC PRESSURE, INCHES OF MERCURY

Fig. 6—Thermal conductivity of glass wool at various densities and partial atmospheric pressures

pressure ranges rather than in the atmospheric pressure ranges.

Thermal Conductivity at Partial Atmospheric Pressures

The effect of partial atmospheric pressure on the conductivity of several insulating materials is shown by the results in Table 3 and by the curves of Figs. 6 and 7. The effect on different widths of air spaces is shown by the results in Table 4 and by the curves in Fig. 8.

There were two samples of glass wool designated as Samples A and B, respectively. While the fibers in both cases were rather fine, those in Sample A were more uniformly and loosely knit together than they were in Sample B. Material in Sample A was tested at three densities: 0.58, 1.94 and 3.8 lb per cubic foot; while material in Sample B was tested at 0.78 lb per cubic foot. One sample each of kapok and silica aerogel was used, the densities being 0.26 and 8.8 lb per cubic foot, respectively.

The conductivities for glass wool in Sample A show very moderate reductions up to about one-third atmosphere, after which the drop off is very pronounced for the high density and very small for the low density, the medium density taking the position between the two extremes. For silica aerogel (test results shown graphically in Fig. 7), the thermal conductivity starts to drop immediately with a reduction in atmospheric pressure and the rate increases as the pressure is reduced.

For glass wool Sample B, which had much larger air spaces than Sample A, there was a reduction in thermal conductivity of about one-half of one percent caused by reducing the pressure from atmospheric to 0.5 in. Hg. For kapok, which appeared to have a coarser fiber than either of the glass wool materials and in which there were rather large air spaces, there was practically no reduction in thermal conductivity caused by reducing the pressure from atmospheric to 0.5 in. Hg.

For the low density wool, Sample A, Sample B, and kapok, it is evident that the greater part of the reduction in thermal conductivity caused by lowering the pressures is in the very low or sub-atmospheric ranges. For the higher densities of Sample A and for silica aerogel, there is a considerable reduction in the atmospheric ranges of pressure.

Air spaces ranging in width from ¼ to 1 in., and bounded by the tarnished copper of the testing plates, were tested under pressures varying from atmospheric down to approximately 0.5 in. Hg. The results of these tests are given in Table 4 and are also shown graphically in Fig. 8. As will be noted from Fig. 8, the conductance of the ¼-in. air space is essentially independent of air pressure. The conductances of the ½-in. to ¾-in. and the 1-in. wide air spaces are reduced by 6.5, 32.0 and 43.0 percent, respectively, as the pressures are reduced from atmosphere to about 0.5 in. Hg. These results can be explained by a consideration of the kinetic theory of gases and the principle of heat transfer by free convection.

The kinetic theory of gases predicts the conductivity of ideal gases to be independent of pressure except at very low pressures. This theory breaks down as the mean free path (the average distance between molecular collision) is of the same order of magnitude or longer than the path of heat flow. At lower pressures the conductivity becomes proportional to the pressure. The mean free path for nitrogen at 32 F is 3.3×10^{-6} in. at 760 mm of mercury pressure, 0.0025 in. at 1 mm, and 2.5 in. at 1 micron of mercury pressure. In all cases the width of the air spaces was greater than the length of the mean free path for the air under the condition as tested.

Transfer of heat by free convection results from the difference in density due to temperature difference. Reducing the density by reducing the pressure would therefore reduce the amount of heat transferred by convection.

Results for the ¼-in. air space indicate that the heat transferred by convection is negligible and illustrates agreement with the kinetic theory. It should be noted that the boundary surfaces of the air spaces were maintained at a constant temperature, thus tending to suppress convection currents.

Conductivity Variations with Density

Since heat is transferred through a material by conduction through the solid portions, by radiation through the open spaces and by any gas that is enclosed in the material, and since increasing the density of a given material changes its characteristics for heat flow by each of these three methods, there is no simple straight-line relation between density and overall conductivity which will apply to all different materials.

Under normal conditions, the rate of heat transfer by conduction would be increased by increasing the density. The effect of density on the amount of heat transmitted through a sample by radiation will depend upon the relation between density and open cells within the material. If the relation should be such that an increase in density would merely decrease the relative sizes of the open cells and therefore increase their number per inch of thickness, the effect would be to increase the resistance to radiant heat per inch of thickness. If, on the other hand, the change should be such that the cells were eliminated, the normal increase in the amount of heat transmitted by conduction might overbalance that which was eliminated by radiation.

A change in density will change the size and perhaps the number of gas cells within a material, which will, in some instances, have a marked effect on the amount of heat transferred by the gas. Since, as shown by the values in Table 1, the gas-transferred heat is often a very important factor in the overall heat transmission for insulating materials, the effect of density on the amount of gas-transferred heat through a specimen may become a dominant factor. If increasing the density of a material merely decreases the size of the cavities without reducing their numbers, this in itself should increase the resistance

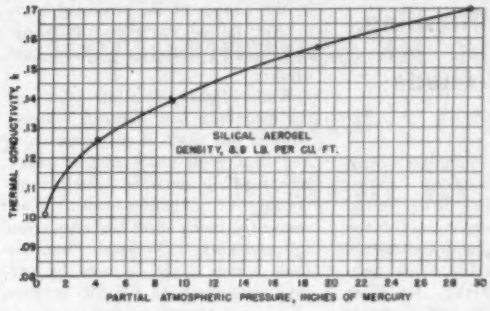

Fig. 7—Thermal conductivity of silica aerogel at various partial atmospheric pressures

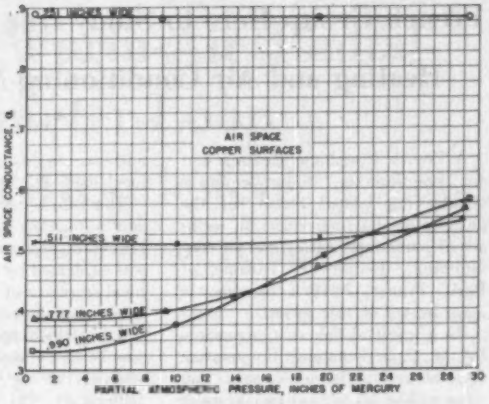

Fig. 8—Thermal conductivity of different widths of air spaces at various partial atmospheric pressures

to gas-transferred heat. However, there is the relation between the length of heat traveled across a cell and the mean free path of the gas molecule which must be considered. The resistance to heat transfer by conduction through a gas is proportional to the length of path over which the heat travels, providing that the length of this path is greater than the mean free path of the molecules of a gas. If the length of the heat path is less than the mean free path of the molecules, then the unit heat resistance becomes greater. For a material made up of fine closely-knit fibers or one having numerous small cells, an increase in density may reduce the size of the cells or the lengths of paths through which the heat travels within a gas to such an extent that the ratio between the length of the heat path and the mean free path of a molecule is reduced to a point where it will materially reduce the amount of heat transmitted by the gas.

The ratio between the length of path through which the heat travels in the gas and the mean free path of the gas molecule may be changed by changing the density of a material, as previously explained, or by changing the pressure of the gas through which the heat is transmitted. The mean free path for nitrogen at 32 F and 760 mm of mercury pressure is 3.3×10^{-6} in. If the pressure is reduced to 1 mm, this becomes 0.025 in.; and when reduced to 1 micron of mercury, it becomes 1.25 in. Under most practical conditions, the rate of change in the ratio is much more pronounced for changes in gas pressure than it is for changes in density of the material. If this ratio is to be materially changed by a change in density, it is obvious that the air or the gas cells within the material must be relatively fine and such that they will be entirely collapsed by an increase in density.

The effect of changing the density of a fine fibrous, closely-knit material through ranges of air pressure above 0.5 in. Hg is shown graphically in Fig. 6. In this instance glass wool at three different densities was tested at pressures ranging from atmosphere to approximately 0.5 in. Hg. An increase in density resulted in a decrease in conductivity at all pressures used.

The reduction in the rate of gas transferred heat caused by a reduction in gas pressure is shown graphically for glass wool A in Fig. 6 and for silica aerogel in Fig. 7. For the glass wool in Fig. 6 there was no material reduction until the pressure had been reduced to about 14 in. Hg. From this point on, the rate of reduction was much higher for the higher densities than for the lower densities. For the silica aerogel, a reduction of conductivity resulted for all reductions in gas pressure, for in this material it is evident that an increase in gas pressures would have increased the rate of conductivity through the material.

In most cases, for insulating materials having coarse cells the reduction in thermal conductivity caused by a reduction of gas pressure is minor for pressure reductions down to 0.5 in. Hg. For the very low pressures of 0.1 microns, or below, there are in most cases material reductions. From an inspection of the curve in Figs. 6 and 7, together with the data shown in Table 1, it is evident that the rate of reduction in heat flow is very much higher for reductions in gas pressures in the low ranges of pressure. This appears to demonstrate the theory that the rate of heat transfer through the gas is reduced by a reduction in pressure after the mean free path of the molecule becomes greater than the distance over which the heat is conducted. For any practical material there is no dividing line at which this ratio becomes greater than one. However, as a material is compressed, or as the gas pressure is reduced, there are more and more of the gas paths traveled by the heat in which the ratio of the mean free path for the gas molecule to the length of path for gas travel is greater than one. Thus it appears that the rate at which the heat resistance is increased becomes greater in the lower ranges of pressure.

French Group Here to Study Our Plumbing, Heating and Air Conditioning Methods

A French Plumbing, Heating and Air Conditioning Study Group is visiting the United States for the purpose of studying American methods of plumbing, heating and air conditioning. Bernard P. Tunzine, of Paris, France, ASHVE member, is team leader of this group.

As a result of this visit, sponsored by the U. S. Economic Cooperation Administration, it is expected that steps will be taken to eliminate much confusion which now exists in France in the relations of the architects, engineers, and contractors. Building construction and the installation of mechanical equipment in buildings proceeds very slowly in France, becaused the practice followed is that which was discontinued in the United States some time ago, namely, that of having contractors submit independent designs and bids for heating, air conditioning and plumbing installations.

In the first conference of the group, held at the Park Sheraton Hotel, New York City, November 6, 1951, L. L. Munier, ASHVE member, represented the contracting industry. He outlined the relation between the architect, the consulting engineer, and the contractor in the United States. He showed particularly how the responsibility was delegated to the consulting engineer for the design of the heating and air conditioning equipment, and pointed out that the contractors for the mechanical equipment submitted bids based upon the plans provided by the consulting engineer. The importance of proper design for mechanical equipment was emphasized by the fact that mechanical equipment approximates one-half of the cost of new, large buildings in New York City.

Mr. Munier also explained the methods by which contractors secure coordination between the various mechanical trades, in order to prevent delays in the installation of equipment. He also pointed out the methods used to insure compliance with local laws and regulations.

The role of ASHVE in collecting and publishing information for the benefit of engineers and contractors was explained by Carl H. Flink, technical secretary of ASHVE. Mr. Flink stated that the Society had six methods by which technical information was being collected, namely: (1) by research at the Society's Research Laboratory, (2) by cooperative research at various universities, (3) by contributions of papers on research conducted at independent institutions, (4) by cooperation of Government bureaus such as the *National Bureau of Standards, U.S. Forest Products Laboratory, the U.S. Weather Bureau,* and State Agricultural Stations, (5) by cooperation with various associations seeking to prepare standards for environment conditions and for performance of equipment, and (6) by consultation with independent practicing engineers for the purpose of securing information on current practice.

The information resulting from the sources mentioned, it was explained, found its way into technical papers and the TRANSACTIONS of the Society, into Standards and Codes, and particularly into THE GUIDE, where it provides engineers and contractors with accepted practice for the design of all types of heating, ventilating and air conditioning systems.

Emphasis was placed upon the willingness of American engineers to contribute information and to cooperate with all groups in disseminating information. Examples of the valuable contributions made by practicing engineers were found in the work done by the members of the many Technical Advisory Committees of the ASHVE, as well as the Codes and Standards prepared, and in the contributions of individual engineers to each annual edition of THE GUIDE.

Since the Group would visit the ASHVE Laboratory on November 21, in the course of its projected tour, a brief outline was given of the operation of the Society's Research Laboratory.

Walter Baker, associate editor of the *Plumbing and Heating Journal,* pointed out that, in all large cities and in a great many smaller cities, all plumbing must be installed according to plumbing codes. Consequently, much effort had been spent in producing a National Plumbing Code which might be used by various municipalities for the purpose of obtaining uniformity in requirements for plumbing installations. He also discussed the relation of the manufacturer of plumbing equipment to the contractor and to the public with regard to the distribution of plumbing fixtures.

A. D. Stout, Jr., associate editor, *Sheet Metal Worker,* spoke of the work of the sheet metal contractor in residence warm air, as well as large air conditioning installations. He showed how standardization of sheet metal fittings and the accumulation of information on warm air heating was improving the work of the sheet metal contractor. Mr. Stout also emphasized the value of the trade press in bringing out information on design and installation of ductwork.

The group will also visit Washington, Pittsburgh, Cleveland, and Chicago, and will inspect outstanding installations of importance in all of these cities. Conferences also will be held in each city visited.

URGES COAL CONVERSION TO FORTIFY FUEL SUPPLY

A great conversion-plant system to fortify and coordinate U. S. fuel supplies by using the nation's immense coal reserves to produce gas of uniform quality for peak-load requirements was proposed recently by Frederic O. Hess, retiring president of the *Gas Appliance Manufacturers Association.*

Speaking before more than 1,000 delegates to the 33rd annual convention of the *American Gas Association* in St. Louis, Hess challenged the gas industry to *take advantage of the fact that we make gas from coal, gasoline from coal, and oil from coal.*

Performance of a Warm-Air Radial-Feeder Perimeter-Loop System in a Residence†

By M. E. Childs,* R. W. Roose,** and S. Konzo††, Urbana, Ill.

SUMMARY—Performance data are given for a radial-feeder perimeter-loop heating system installed in Warm-Air Heating Research Residence No. 3 at the *University of Illinois*. This Residence was a low-cost basementless house with a concrete slab floor laid on the ground.

The radial-feeder perimeter system consisted of an 8-in. diameter warm-air duct embedded in the concrete slab in the form of a single loop around the periphery of the floor, and of a series of 8-in. diameter radial-feeder ducts connecting the perimeter duct with a subfloor plenum below the furnace.

Four arrangements of feeder ducts were studied, including two arrangements with three feeders each, a four-feeder arrangement and a five-feeder arrangement. Best results were obtained with the arrangements in which feeder ducts were extended into the corners of the Residence. The system gave excellent results; room-air temperature differentials were small, cold areas on the floor surfaces were practically eliminated, and no difficulty was experienced in the thermostatic control of room-air temperature during periods of rapidly changing weather conditions.

THE CONSTRUCTION of homes provided with a concrete slab floor laid on the ground, has introduced such difficulties as cold floor surfaces and condensation on these surfaces.[1] The problems are accentuated when a slab floor is used in connection with low-cost housing which is just sufficient to comply with minimum construction standards. The use of conventional warm-air heating systems has not completely solved the problem of cold floors even with insulation of the floors. Hence, many new approaches have been suggested[2] and some of these have given satisfactory performance in field installations. One such approach of distinct promise is that designated as the warm-air radial-feeder perimeter-loop heating system, hereafter designated as a radial-feeder perimeter system.

In previous reports of the results obtained in the Floor Slab Laboratory, data were given for heat emission[3] from slab floors heated by embedded warm-air ducts, temperature drop[4] of the air circulating in the ducts, and subfloor heat losses.[5] These studies were devoted to a determination of design factors for a perimeter system and were conducted under laboratory conditions. Hence, for the purpose of obtaining performance data of a complete perimeter system in an actual residence, corollary studies were conducted in Warm-Air Heating Research Residence No. 3. One arrangement of a perimeter system, designated as a two-loop perimeter system, was studied[6] during the 1949-50 heating season. Although the overall performance of this system was superior to those obtained with conventional forced-air systems utilizing either high-wall or low-wall registers, the results indicated that the performance could be improved by rearranging the embedded ducts. Therefore, during the 1950-51 heating season a radial-feeder perimeter system was investigated. In order to determine the optimum number and location of the feeder ducts, several duct arrangements were studied.

The overall objectives of this investigation were to determine:

1. Uniformity of room-air temperatures at the sitting level throughout the house, and the response of the system to thermostatic control,
2. Room-air temperature differentials between the floor level and the sitting, breathing, and ceiling levels,
3. Pattern of floor surface temperatures with various duct arrangements,
4. General performance characteristics of the burner and blower, including the pressure losses, and a heat balance for the system.

This paper reports only the results obtained with the radial-feeder perimeter system.

Description and Procedure

Residence No. 3, shown in Fig. 1, was a single story, low-cost home with a concrete slab floor. The Residence, which was of standard frame construction, was provided with a relatively large amount of glass area. The walls were uninsulated but the ceiling was insulated with mineral wool batts of 3½ in. thickness. With the exception of one picture window, double-hung wood-sash windows were used. The windows were not weatherstripped nor were they equipped with storm sash;

†This investigation is a part of the cooperative project jointly sponsored by the *Engineering Experiment Station* of the *University of Illinois* and the *National Warm Air Heating and Air Conditioning Association*. This paper reports one phase of an extensive study conducted in Warm-Air Heating Research Residence No. 3 during the period from 1949 to 1951. This investigation is being continued for the purpose of studying different methods of air distribution and the use of small ducts.

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[1]Exponent numerals refer to References.

For presentation at the 58th Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, St. Louis, Mo., January 1952.

Fig. 1 — Warm-Air Heating Research Residence No. 3

however, storm doors were used. A floor plan of the Residence is shown in Fig. 2. The inside dimensions were 24 ft x 32 ft and the corresponding floor area was 768 sq ft. The design heat loss of the Residence for an outdoor temperature of −10 F and an indoor temperature of 70 F was about 51,600 Btu per hr.

The floor slab construction shown in Fig. 3 consisted of a 4-in. gravel fill placed on the original grade, a heavy duplex-paper vapor barrier (dampproofing membrane) tarred at the joints, and 4 in. of concrete. The insulation at the edge of the slab consisted of a 25/32-in. asphalt-coated fiber insulating board placed against the foundation wall and extended downward 12 in. from the top of the slab.

The radial-feeder perimeter system consisted of an 8-in. diameter warm-air duct embedded in the concrete slab in the form of a single loop around the periphery of the floor with a series of 8-in. diameter radial-feeder ducts connecting the perimeter duct to a subfloor plenum below the furnace. A total of seven feeder ducts was installed, and provisions were made for blocking each duct at both ends so that any combination of the seven feeder ducts could be studied. The feeder ducts were 4 in. below the floor surface at the plenum and sloped upward to the junction with the perimeter duct which was 2 in. below the floor.

A gas-fired down-flow furnace having an input rating of 65,000 Btu per hr for natural gas was used. The warm air was delivered directly into the subfloor plenum below the furnace from which point it was forced outward through the radial-feeder ducts to the perimeter duct and then through the floor registers. The air moved across the rooms to a single return-air intake in the living room and then into the furnace to be reheated.

Four studies designated as Series P-11, P-12, P-13, and P-14 were conducted, and the duct arrangements are shown in Fig. 4. The three-feeder arrangements (Series P-11 and P-12) were considered to be minimum installations for a structure of the size of Research Residence No. 3, whereas the five-feeder arrangement (Series P-14) was considered an optimum.

The desired fuel input rate of 65,000 Btu per hr was obtained by adjusting the gas-flow rate at the meter. This input rate of 65,000 Btu per hr was determined by dividing the design heat loss (51,600) by the assumed bonnet efficiency (0.80) of the furnace. The thermostat which was located at the 30-in. level in the living room was set at 72 F. The differential setting of the thermostat was adjusted to the minimum point to provide frequent burner operations.

Complete instrumentation was provided for temperature measurement, including approximately 250 copper-constantan thermocouples. Instrumentation was also provided to measure the relative humidity, electrical inputs to the gas valve and to the blower motor, the fuel input rate, the flue gas composition, the hours of operation of the blower and burner, and the air-flow rates in the duct system.

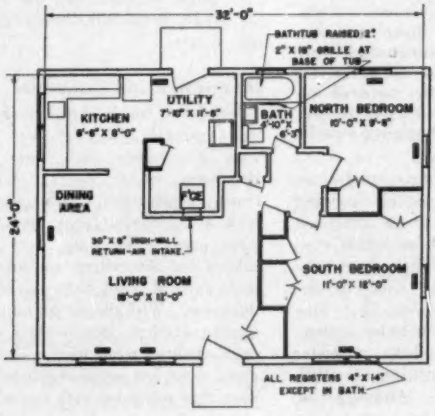


Fig. 2 — Floor plan of Research Residence No. 3

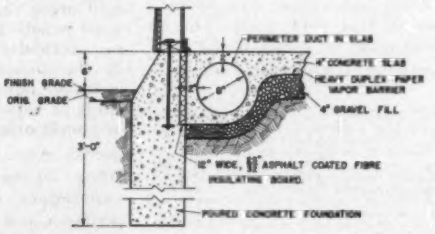


Fig. 3 — Details of floor slab construction showing perimeter duct

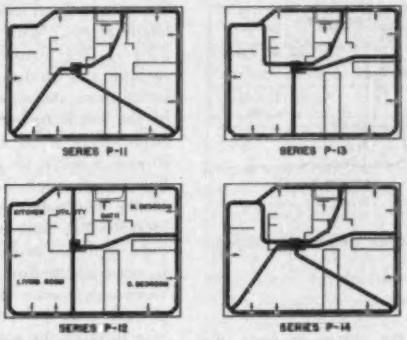


Fig. 4 — Four arrangements of radial-feeder perimeter-loop system

Comfort is a difficult item to evaluate and depends upon a large number of factors, such as air temperatures, surface temperatures, relative humidity, and air movement, as well as a number of less tangible items, such as odor, noise, and dust content. Since it was not possible to evaluate all of these items, emphasis was placed upon two predominant factors: room-air temperatures and floor surface temperatures. The study of air temperatures was devoted primarily to the conditions obtained in the living zone between the floor level and the breathing level, since temperatures above the breathing level are of little significance as far as comfort conditions in the home are concerned.

Uniformity of Room-Air Temperatures at Sitting Level

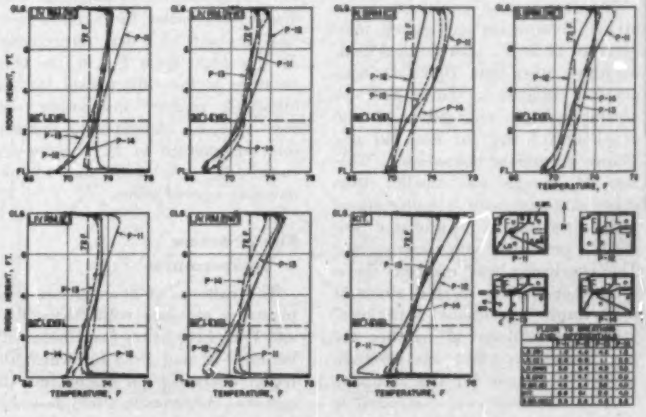
The cyclical variation of room-air temperatures was negligible with all four series, amounting to less than 0.5 deg. Also, the response of the system to sudden changes in outdoor temperature was considered to be satisfactory since no evidence of lag or overrun of room-air temperatures was experienced during periods of rapidly changing outdoor temperatures. Little difficulty was encountered in balancing the system. By merely adjusting the shutter dampers in the floor registers, the temperature in any room in the Residence could be readily raised or lowered. In the case of Series P-12 and P-13, for which corner feeder ducts were not used, the balancing process required more care than with either Series P-11 or P-14, as will be discussed later.

The best balance was obtained with Series P-14, in which five feeder ducts were used. The temperature difference between the living room and the two bedrooms was consistently less than 1 deg, whereas with the other three series the temperatures in the bedrooms were generally 1 to 2 deg lower than those in the living room.

The temperature difference between the warmest and coolest areas of the living room was only 1 to 2 deg for all four series of studies. In those arrangements in which corner feeder ducts were not used (Series P-12 and P-13) the air temperatures near the corner of the room were 1.0 to 1.5 deg cooler than for those arrangements utilizing corner feeder ducts (Series P-11 and P-14). This difference indicates the desirability of extending feeder ducts into the corner areas.

Room-Air Temperature Differentials

Satisfactory temperature differentials were obtained with all four feeder duct arrangements. The temperature gradients at seven measuring stations in the Residence for an outdoor temperature of about 20 F are shown in Fig. 5. A summary of the differentials between the floor and breathing levels is included with the figure. The average differential for the five-feeder arrangement (Series P-14) was only 2.7 deg, which was about 0.8 deg lower than those for the other three arrangements. This improvement was attributed to the larger panel heating effect resulting from the use of a larger number of feeder ducts and to the more effective location of the feeder ducts. In any case, the temperature differ-



(Weather: No Sun; Wind 2-7 mph (N.W.); Outdoor Temp., 18-21 F)

Fig. 5 — Room-air temperature gradients for radial-feeder perimeter-loop systems

entials, ranging from 2.7 to 3.5 deg for the radial-feeder perimeter system, were only about one-third as large as those observed with three conventional warm-air systems studied[6] previously in the same Residence. Furthermore, the temperature differentials for the radial-feeder perimeter system were equally as good as those experienced with conventional warm-air systems studied[7] in Research Residence No. 2 which was a fully insulated one-story structure with full basement.

Based upon a comparison of the differentials shown in Fig. 5, the following generalizations were made:

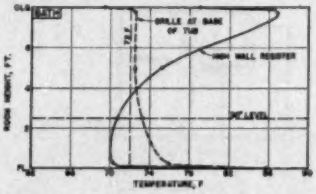
1. Locating the feeder ducts so that they extended into exposed corners of the floor provided an additional heat source in an area which tended to be cool, resulting in more satisfactory differentials in those areas. (Compare difference between Series P-11 and P-12 for living room east with difference between the same series for living room west.)

2. Locating the registers below windows resulted in lower differentials. This resulted from the fact that the warm air mixed with the downward current of cool air from the windows. (See Series P-11. Compare kitchen and living room northwest.)

3. The use of a larger number of feeder ducts generally resulted in improved differentials since the panel heating effect was increased. (Compare Series P-11 and P-14.) However, the location of the feeder ducts was more important than the number used, provided that the number was sufficient to assure an adequate delivery of warm air to all sections of the perimeter duct. (Compare Series P-11 and P-13.)

The temperature gradients shown in Fig. 5 were for an outdoor temperature of 20 F. For outdoor temperatures other than 20 F, the temperature differential from floor to breathing levels changed at a rate of about 0.5 deg for each 10 deg change in outdoor temperature. This rate of change was smaller than those observed with a conventional warm-air system in an insulated residence[7] provided with storm sash. The conclusion was reached, therefore, that as far as the room-air temperature conditions were concerned, the change in weather did not materially affect the environmental conditions for the occupant.

A special study was conducted in the bathroom with two arrangements of warm-air registers. In an earlier



(Weather: No Sun; Wind, 4-7 mph; Outdoor Temp., 10-12 F)

Fig. 6 — Room-air temperature gradients in bathroom

installation the warm air was delivered into the bathroom through a high-wall register, which was connected by means of a stack to the perimeter duct. In the second installation the warm air was delivered into the bathroom through a register located at the base of the bathtub. For this purpose the bathtub was raised 2 in. above the floor, and warm air was delivered directly from the perimeter duct into the space below the bathtub and then into the room. In both arrangements, a feeder duct was embedded in the floor of the bathroom. Typical temperature gradients obtained at an outdoor temperature of 10 F are shown in Fig. 6. The temperature differentials when the high-wall register was used were 5 deg between the floor and breathing levels, and 16.6 deg between the floor and ceiling levels. The corresponding differentials with the delivery below the bathtub were −3.4 deg and −3.4 deg, respectively. As is evident from Fig. 6, the temperature at the sitting level for the high-wall register installation was only 70.7 F. Attempts to increase this temperature to 72 F were not successful, even with the register dampers opened wide.

Floor Surface Temperatures

The patterns of floor surface temperatures obtained with Series P-14 and P-11 were better than those with Series P-12 and P-13 for which the feeder ducts did not extend into the corners. Attempts to attain desirable floor surface temperatures with Series P-12 and P-13 involved difficulties in obtaining a good balance of room-air temperatures. With these series the floor surface temperatures were low in both the southeast corner of the living room and the southwest corner of the south bedroom. By suitable adjustments of the register dampers, it was possible to increase the air-flow rate through the corner sections of the perimeter duct and thereby increase the floor surface temperatures in those corners. However, the increase in the flow rate through the corner perimeter duct was accomplished only by reducing the flow rate through the register nearest the feeder duct, which in turn made it difficult to supply sufficient heated air to the room to maintain the desired room-air temperature. Furthermore, the reduction in flow rate through the nearest register resulted in excessive air velocities through the register farther down the duct.

Typical floor surface isotherms are shown in Fig. 7 for Series P-11. These isotherms represent conditions at the end of a three-day period during which the outdoor temperature was about 30 F, cloudy weather prevailed, and the wind was approximately 10 mph from the west. Although a more uniform pattern of temperatures was obtained with the five-feeder arrangement (Series P-14) than with Series P-11, the pattern for the simpler three-feeder arrangement has been shown, since it is more representative of the type of perimeter systems applicable to small houses.

In connection with Fig. 7, the following observations were made:

1. The floor surface temperatures in the kitchen were low. This resulted from the fact that the distance along the feeder and perimeter ducts from the subfloor plenum was great. However, since most of the floor area was devoted to cabinets and was not normal living space, the temperatures were not considered to be critically low. This low temperature area does indicate the need for extending feeder ducts into corner areas as well as for having all sections of the perimeter duct at relatively short air-flow distances from the subfloor plenum. With Series P-14 a feeder duct was extended into the corner of the kitchen and the resulting floor surface temperatures were considerably improved over those shown in Fig. 7.

2. The practically parallel isothermal lines over the feeder ducts were typical for a perimeter system in which the depth of the feeder ducts varied from about 4 in. at the furnace to 2 in. at the junction with the perimeter duct. This temperature pattern closely resembles that obtained from the studies in the Floor Slab Laboratory.[4]

3. For an outdoor temperature of 30 F the maximum floor surface temperatures did not exceed 85 F, except for an area within about 2 ft of the subfloor plenum. Under average winter weather conditions for the locality, therefore, the floor surface temperatures in the entire living area were well below the commonly accepted[5] maximum value of 85 F.

From an analysis of the floor surface temperatures experienced over a wide range of indoor-outdoor temperature differences, the following generalizations were made:

1. As the outdoor temperature decreased, the floor surface temperatures in those areas away from the embedded ducts, and in areas near the perimeter duct but at a considerable distance from the subfloor plenum, did not change appreciably from those shown in Fig. 7. However, surface temperatures exceeding 85 F were obtained in three localized areas:

a. The temperature of the floor near the furnace increased considerably with the higher duct-air temperatures which accompanied low outdoor temperatures. For example, the surface temperatures directly above the feeder duct and 15 in. from the subfloor plenum increased to 110 F when the bonnet-air temperature was near the maximum value of 170 F. The surface temperatures decreased sharply, however, with an increase in distance from the subfloor plenum, so that the temperature above the feeder ducts attained a maximum value of only 95 F at a distance of 5 ft from the plenum. Furthermore, at a distance of 15 in. from the plenum and 18 in. from the nearest feeder duct, the floor surface temperature attained a value of only 85 F.

b. Beyond a distance of 5 ft from the plenum, the surface temperatures directly above the feeder ducts attained values of 95 to 100 F at an outdoor temperature of —10 F. Also, temperatures in excess of 85 F existed for a distance of less than 15 in. on each side of the centerline of the ducts.

c. Warm floor surfaces were obtained directly above the tee connections that joined the feeder duct to the perimeter duct. For an outdoor temperature of —10 F this surface temperature was about 100 F.

2. From the standpoint of comfort, as affected by floor surface temperatures, the commonly accepted[5] maximum values are 85 F for living spaces and 120 F for borders and aisles. Since the surface temperatures observed near the furnace and over the tee fittings were less than the value of 120 F for borders, neither of these areas was considered critical. It is true that a narrow strip of floor above the feeder ducts attained temperatures in excess of the 85 F accepted as a maximum for living areas. However, since such temperatures were obtained only in severe weather and since the critical area was narrow, exceeding these accepted limits was not considered serious.

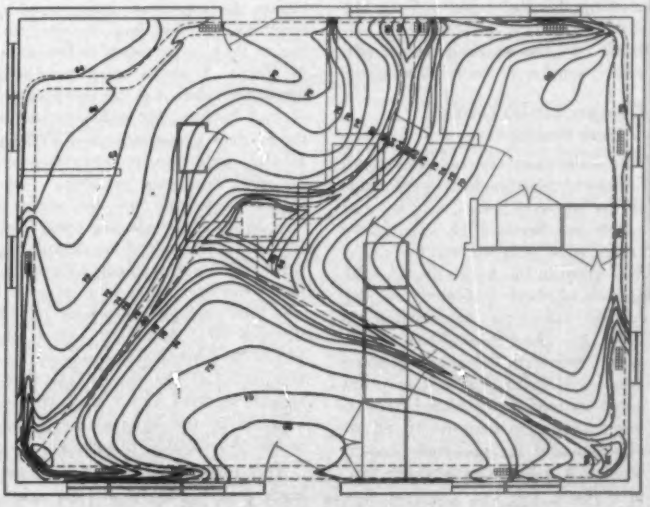
Performance of the Burner and Blower

Complete performance data for the burner and blower were obtained over a wide range of indoor-outdoor temperature differences. The general performance characteristics of the burner and blower were essentially the same for all four duct arrangements since the operating conditions of the furnace were identical. These operating conditions were in accordance with those recommended in the continuous air circulation principle.[9] That is, the differential setting of the room thermostat was adjusted to provide short cycling of the burner during mild weather, the fuel input rate was adjusted to a value equal to the heat loss of the house divided by the assumed bonnet efficiency, the blower was adjusted to provide a temperature rise through the furnace of 100 deg, and the fan switch settings were low enough to cause the blower to operate almost continuously. A summary of the performance data for an outdoor temperature of 35 F is shown in Table 1.

Table 1—Summary of Performance Data for Burner and Blower at an Outdoor Temperature of 35 F

a. Blower operation, hours per day	22.3
b. Blower cycles, per 24 hr	10
c. Electrical input to blower motor, watt hours per day	2700
d. Average bonnet-air temperature, Fahrenheit	115
e. Burner operation, hours per day	8
f. Burner operations per 24 hr	115
g. Average flue gas temperature, Fahrenheit	265
h. Fuel consumption, cu ft of gas per day	500

A comparison was made of the actual fuel consumption with the theoretical requirements. For instance, the fuel consumption curve indicated an average consumption of 1,175 cu ft per day (49,000 Btu per hr) at an indoor-outdoor temperature difference of 80 deg and an average wind velocity of only 7.5 mph. For these same weather conditions the calculated heat loss was 43,200 Btu per hr and the corresponding theoretical input rate was 54,000 Btu per hr for an assumed bonnet efficiency of 80 percent. This difference of approximately 5,000 Btu per hr between the actual and theoretical input rates was attributed to the vagrant heat gains from the furnace casing and flue pipe, and the direct heat gains from lights, etc.



(Weather: No Sun; Wind, 9-12 mph (S.W.); Outdoor Temp., 30-35 F)

Fig. 7 — Floor surface isotherms with radial-feeder perimeter-loop system (Series P-11)

Table 2—Pressure Losses for Perimeter Duct System (*For Series P-11*)

	Calculated Values From Appendix A* (1)	Observed Values* (2)
1. Total Air-Flow Rates		
a. Return Air	478 cfm	500 cfm
b. Supply Air	555 cfm	500 cfm
2. Pressure Losses Through Warm-Air Duct System		
a. Feeder Duct	0.0570 in. of water	[b]
b. Perimeter Duct	0.0036 in.	[b]
c. Registers	0.007[c] in.	0.025 in.
d. Total	0.0676	0.070 in.
3. Pressure Losses Through Return-Air Duct System		
a. Return-Air Duct	0.005 in.	[b]
b. Return-Air Duct	0.018 in.	[b]
c. Total	0.023 in.	0.028 in.
4. Total Pressure Available External to Blower	0.0906 in. of water	0.098 in. of water

[a] Values based on theoretical cfm requirements for system.
[b] Measurements made with no heat supply to furnace.
[b] Not measurable.
[c] Estimated value based on wide-open register.

On the assumption that this difference of 5,000 Btu per hr for vagrant and direct heat gains would also occur under design conditions (51,600 Btu per hr heat loss for an indoor-outdoor temperature difference of 80 deg and 15 mph wind velocity), a margin of safety amounting to 8 percent of the theoretical input rate of 65,000 Btu per hr would be provided. Hence, the practice of selecting the fuel input rate on the basis of the total calculated heat loss divided by the assumed bonnet efficiency appears to be reasonable.

Pressure Losses for the Duct System

In connection with the blower performance, measurements were made of the pressure losses for the duct system for Series P-11. Calculated values were obtained by the procedure given in the Appendix. A comparison of these measured and calculated values is summarized in Table 2. The values shown in column 1 represent calculated pressure losses. Although a discrepancy was noted between the estimated pressure loss through the registers (0.007 in. of water and the observed pressure loss 0.025 in.) the totals of the pressure losses for the warm-air duct system (Item 2*d*) were practically the same. A reasonably good agreement was also shown in the corresponding values for the return-air duct system (Item 3*c*) and for the entire system (Item 4). Considering the numerous assumptions made in the calculation procedure, and the fact that the air-flow rates (Items 1*a* and 1*b*) were not in agreement, the correlation between the actual and calculated values was good. This was particularly true when the calculated pressure losses for the ducts (Items 2*a*, 2*b*, and 3*a*) were adjusted to the actual flow-rates, and the calculated register loss (Item 2*c*) was arbitrarily increased to the measured value of 0.025 in. In any case since the total loss of the entire duct system was only of the order of 0.10 in., and since the blower-furnace unit was rated to discharge air against an external static pressure of 0.20 in., it was apparent that the warm-air ducts could have been reduced in size.

Heat Balance

A detailed study was made of the heat balance for the radial-feeder perimeter system (Series P-11 and P-12). The heat gains and heat losses for the Residence were computed from established heat transfer equations and special measurements. Since the calculations were too extensive to reproduce here, only a summary of the final results for Series P-11 is presented. The data in Table 3 show calculated and measured values for the components of heat balance, for a day in which the outdoor temperature was 35 F, a 10 mph wind velocity prevailed, and no solar heat gain occurred. The calculated values for the subfloor heat loss and the above-ground heat loss were determined in accordance with the usual methods for calculating the heat losses of a structure. The total calculated loss was 21,700 Btu per hr. Assuming a flue gas loss of 20 percent, which was equivalent to 5,450 Btu per hr, the theoretical required input rate (to be supplied by the furnace) was determined to be 27,150 Btu per hr.

The following observations were made from an analysis of the calculated and measured values presented in Table 3:

Table 3—Components of Heat Balance for Radial-Feeder Perimeter System (*Series P-11*)

Items	Calculated Values, Btu per Hr	Measured Values, Btu per Hr
1. Subfloor Loss	5,050	6,280
2. Above-Ground Losses	16,650	16,100
Offset by:		Subtotals
a. Warm air from floor registers		9,350
b. Panel Heating effect		3,090
c. Furnace casing heat transfer		1,100
d. Flue pipe heat transfer		370
e. Electrical energy		1,190
f. Energy from Observers		1,000
3. Subfloor and Above-Ground Losses	21,700	22,380
4. Flue Gas Loss	5,450	5,970
5. Total Input Rate	27,150	26,350
6. Supplied by Furnace	27,150	23,750

Note: Values based on outdoor temperature of 35 F and wind velocity of 10 mph. Observed values determined on Feb. 16, 1951, during which wind was from the southwest and no solar heat gain occurred.

1. The calculated value for subfloor loss (Item 1), as based upon a heat loss factor of 45 Btu per hr per linear foot of exposed edge of the floor slab, was low. This was attributed to the fact that the factor of 45 Btu per hr was determined in the Floor Slab Laboratory[39] for a 1-in. thick insulation which extended 18 in. downward along the edge of the slab, whereas in Research Residence No. 3 the insulation was only 25/32 in. thick and extended downward to a depth of only 12 in.

2. The calculated value for the above-ground heat loss was in excellent agreement with the measured value (Item 2).

3. The net flue gas loss, as measured at the point where the flue pipe left the living space, was only 3,970 Btu per hr. When the heat regains from the flue pipe (Item 2*d*) and the furnace casing (Item 2*c*) were taken into account, the gross of 5,440 Btu per hr was practically identical to the calculated value of 5,450 Btu per hr. The calculated value is based upon the conditions at the flue outlet of the furnace.

4. Although the total measured input rate to the Residence was 26,350 Btu per hr, the heat supplied by the furnace amounted to only 23,750 Btu per hr. The difference was attributed to the electrical energy input (Item 2*e*) and the heat gain from observers (Item 2*f*).

5. The only unavailable energy was the net flue gas loss as determined at the ceiling level where the flue pipe left the living space. This was equivalent to 16.7 percent of the average hourly fuel input to the furnace. In other words, the overall efficiency of the furnace in this installation can be considered to be 100.0—16.7, or 83.3 percent.

6. The value for the panel heating effect from the heated floor slab (Item 2*b*) was about one-third as large as that for the

energy entering the rooms through the registers (Item 2a). In other words, the system functioned primarily as a convection system, but to some extent as a panel heating system. The total of Items 2a and 2b was 12,440 Btu per hr, which represented about 77 percent of the heat supplied to offset the above-ground heat loss. The remaining 23 percent was supplied by direct and vagrant heat gains.

Conclusions

The radial-feeder perimeter system discussed in this paper consisted of an 8-in. diameter warm-air duct embedded in the concrete slab in the form of a single loop around the periphery of the floor and of a series of 8-in. diameter radial-feeder ducts connecting the perimeter duct to a subfloor plenum below the furnace. A down-flow furnace was used with the system and the warm air was forced directly from the furnace into the subfloor plenum from which point it was delivered through the feeder ducts to the perimeter duct and then into the rooms through floor registers. The air moved across the rooms to a single return-air intake in the living room and then into the furnace to be reheated.

The response of the system to sudden changes in outdoor temperature was considered to be satisfactory since no evidence of lag or overrun of room-air temperatures was experienced during periods of rapidly changing outdoor temperatures. The conventional room thermostat used with the system proved to be satisfactory for controlling the room-air temperature. The practice of balancing the system by means of adjusting the shutter dampers on the floor registers proved to be satisfactory.

Room-air temperature differentials were small. For example, at an outdoor temperature of 20 F the temperature differentials from the floor level to the breathing level ranged from 2.7 to 3.5 deg for the four duct arrangements. These temperature differentials were equally as good as those experienced with a conventional warm-air system in a well-insulated house with a full basement.

Floor surface temperatures were satisfactory for the duct arrangements in which feeder ducts extended into the exposed corners of the floor. In cases where feeder ducts were not extended into the corner areas, the floor surface temperatures tended to be low. Floor surface temperatures in excess of the commonly accepted maximum value of 85 F for living areas were experienced. However, these temperatures occurred only in narrow sections of floor directly above the feeder ducts and were not considered critical. In no case did temperatures above the perimeter duct, or in areas along the walls adjacent to the subfloor plenum, exceed the value of 120 F commonly accepted as the maximum for borders and aisles.

The operating conditions for the system, which were exactly the same as those for the continuous air circulation principle, proved to be satisfactory for the perimeter system.

The actual pressure losses for the warm-air and return-air duct systems were in reasonably good agreement with the calculated values. Furthermore, the pressure loss external to the blower-furnace combination was less than the 0.20 in. of water available. This indicated that some reduction in the size of feeder and perimeter ducts could be made without exceeding the limit of 0.20 in.

In connection with the fuel input rate a comparison of the actual fuel consumption with the theoretical requirements indicated that there was a margin of safety of 8 percent in determining the theoretical input rate. This difference of 8 percent between the actual and theoretical requirements indicates that the practice of selecting the fuel input rate on the basis of the total calculated heat loss divided by the assumed bonnet efficiency is reasonable.

On the basis of the results obtained with the four separate arrangements for the radial-feeder perimeter system it was evident that such a system should be designed so that (1) feeder ducts extend into exposed corners of the floor, (2) the total air-flow distances from the subfloor plenum to the registers are relatively short, and (3) relatively high air-flow rates are maintained in all sections of the perimeter ducts.

Acknowledgments

This paper reports one phase of a comprehensive investigation conducted in Warm-Air Heating Research Residence No. 3 under the terms of a cooperative agreement between the *National Warm Air Heating and Air Conditioning Association* and the *Engineering Experiment Station of the University of Illinois*. These results will ultimately comprise part of a bulletin of the Engineering Experiment Station.

This paper includes material from two theses completed under the direction of Prof. S. Konzo and submitted, in partial fulfillment of the requirements for the degree of Master of Science in Mechanical Engineering, by G. W. Sadler in 1951 and J. E. Sjordal in 1950.

APPENDIX

Calculated Pressure Losses for the Duct System

The following summary gives essential details of the simplified procedure followed in calculating the pressure losses for the radial-feeder perimeter system. The duct system for the three-feeder arrangement (Series P-11) was considered.

1. The design heat loss for the Residence, including the subfloor loss, was calculated as 51,600 Btu per hr.

2. The design bonnet-air temperature was assumed to be 170 F and the return-air temperature to be 70 F. Therefore, the design temperature rise through the furnace was 100 deg.

3. The air-flow rate in the return-air duct was calculated to be 478 cfm at a temperature of 70 F.

4. The average length of the feeder ducts was 18 ft. The average temperature drop through the feeder ducts was assumed to be 30 deg, giving an average feeder duct-air temperature of 155 F. The total air-flow rate in all the feeder ducts, at a temperature of 155 F, was calculated to be 555 cfm. This value was also used for the total air-flow rate entering the perimeter duct.

5. The average air-flow rate through each of the three feeder ducts was assumed to be one-third of 555 cfm, or 185 cfm. The average flow through any section of the perimeter duct was assumed to be one-half of 185 cfm, or 93 cfm.

6. The pressure loss for the 8-in. diameter feeder duct was determined from the air-friction chart[8] as 0.065 in. of water per 100 ft of duct. The total equivalent length of a single feeder duct (including subfloor plenum entrance, a 90-deg elbow, and tee junction) was 88 ft. The pressure loss in the feeder duct was 0.88 x 0.065, or 0.057 in. of water.

7. The average length of perimeter duct from the tee junction to the midpoint of the perimeter duct, included between two junctions, was 20 ft. The pressure loss for the 8-in. diameter perimeter duct carrying 93 cfm was determined from the air-friction chart as 0.018 in. per 100 ft of duct. The pressure loss for the 20-ft section of duct was 0.20 x 0.065, or 0.0036 in. of water.

8. Since the perimeter duct size was constant, the duct was considered to function as an extended plenum. Hence, it was assumed that the static pressures would be practically constant at all sections in the perimeter duct.

9. The average air-flow rate through each of the nine registers was assumed to be 63 cfm. Since no data were available on pressure losses through a floor register at right angles to the direction of flow in the main duct, the available information on a register in a stackhead was used. For this purpose, the data from Reference 11 (p. 42, Table 11) for a 14 in. x 4 in. register were used. The register resistance was given as 0.051 in. for a stack velocity of 500 fpm. For the average stack velocity of 180 fpm, corresponding to the average conditions in the perimeter installation, the register loss was considered to be 0.007 in. for a wide open register. If dampering were used, the value of 0.007 in. would be low.

10. The equivalent length of the 8 in. x 20 in. return-air duct, including one 90-deg shortway elbow, was 17 ft. The pressure loss for the duct for the air-flow rate of 478 cfm was 0.03 in. per 100 ft, or 0.005 in. for the 17-ft length.

11. From Reference 11 (p. 22, Fig. 6) the pressure loss for a bar register having 75 percent free-area opening was shown to be equal to 2.0 velocity pressures. Hence, the pressure loss for the 30 in. x 8 in. return-air intake at a free-area velocity of 382 fpm was considered to be 0.018 in.

A comparison of these calculated pressure losses and the measured pressure losses is presented in Table 2.

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11. Pressure Losses in Registers and Stackheads in Forced Warm-Air Heating, by A. P. Kratz and S. Konzo (*University of Illinois Engineering Experiment Station, Bulletin 342*, 1943).

ECRC Review Reveals Current Research Projects In Heating, Ventilating, and Air Conditioning

The 1951 Review of Current Research has recently been published by the Engineering College Research Council of the American Society for Engineering Education. The Review contains a number of interesting items for heating, ventilating, and air conditioning engineers, among them being current research projects in heating, ventilating, and air conditioning at member institutions of ECRC. Those projects likely to be of interest to Society members have been extracted from the Review and compiled into list form by Cyril Tasker, director of research, ASHVE Research Laboratory, Cleveland. The list, which also shows the names and addresses of the various institutions, and the name and title of each responsible officer, is reproduced here.

Projects currently under way in cooperation with the Society are marked with asterisks.

Alabama Polytechnic Institute — Auburn, Ala. Dean J. E. Hannum (School of Engineering).
Studies in the rates of drying.

University of Arkansas, Engineering Experiment Station — Fayetteville, Ark. Prof. R. G. Paddock, Mechanical Engineering.
Heat transfer through clothing.

Polytechnic Institute of Brooklyn — Brooklyn, N.Y. Prof. E. L. Midgette, Mechanical and Metallurgical Engineering.
Flow through miniature orifices.

California Institute of Technology — Pasadena, Calif. Prof. F. C. Lindvall, Chairman, Division of Engineering.
Investigations in the initiation of combustion using interferometer techniques.
Axial flow compressor blading studies.

University of California, Institute of Engineering Research — Berkeley, Calif. Dean M. P. O'Brien, College of Engineering.
Normal and abnormal velocity distribution in pipes.
Fluid and mechanical friction losses in small pumps handling viscous fluids.
Behavior of isothermal flow of gas-liquid mixtures in tubes.
Heat transfer to boundary layers.
Temperature distribution near the wall in turbulent non-isothermal pipe flow.
Velocity and temperature distributions resulting from fluid mixing in a conduit.
Determination of local heat transfer coefficient for free convection for a cylinder in air.
Local heat transfer coefficients on a cylinder.
Fundamental factors influencing pitot tube measurements.
Cooling tower performance; heat transfer and pressure drop.
Gas velocity measurements with impact tubes.

University of California — Los Angeles, Calif. Prof. L. M. K. Boelter, Chairman (Department of Engineering).
Effects of heat transfer in aircraft.
Human heat tolerance: study of mental and psychomotor performance during thermal stress.

Carnegie Institute of Technology, College of Engineering and Science — Pittsburgh, Pa. Prof. D. W. VerPlanck, Mechanical Engineering.
Mixing of fluid streams.

Case Institute of Technology — Cleveland, Ohio. Prof. George L. Tuve, Mechanical Engineering.
Heat and moisture transmission through building walls.
Heat transfer and pressure drop for "Freon-12" evaporating inside horizontal tubes.
*Air distribution from grilles, slots and ceiling outlets.
*Performance of free air jets.
Performance of cooling towers and air washers.
The effect of turbulence on flame propagation in flowing air-fuel mixtures.

University of Colorado, Engineering Experiment Station — Boulder, Colo. Prof. Wayne S. Beattie, Mechanical Engineering.
Basic research on fuel injection and combustion.
Measurement of pulsating flow.

Cornell University, Engineering Experiment Station — Ithaca, N.Y. Prof. H. J. Leberg, Mechanical Engineering.
Determination of moisture and density of soil.
Extended-surface heat exchangers.
Hydraulic analog for research on heat transfer problems.
*Sol-air temperatures and periodic heat flow.

University of Detroit — Detroit, Mich. Prof. I. J. Uicker, Mechanical Engineering.
Friction loss in pipe, tubing, and fittings.
The flow of saturated air through orifices.
Performance data of pipes buried in various soils for use in heat pump work.

*Projects underway in cooperation with ASHVE.

University of Florida, Engineering and Industrial Experiment Station — Gainesville, Fla. Dr. Ralph A. Morgen, Director.
Method for making a hydraulic analog for periodic heat transmission.
*Air entrainment in hot water systems.

Illinois Institute of Technology — Chicago, Ill. Prof. Chester A. Arents, Coordinator of Research; Prof. Frank D. Carvin, Mechanical Engineering; Prof. Max Jakob, Heat Transfer Research.
Frictional resistance in rough pipes.
Measurement of atmospheric pressure.
Heat transfer in small-diameter cylinders.

University of Illinois, Engineering Experiment Station — Urbana, Ill. Prof. N. A. Parker, Mechanical Engineering.
Revaluation of the ice point and the constant pressure gas thermometer corrections.
Development of a method and instrument for determining the thermal diffusivity of soils in place.
Heating, ventilating, and air conditioning as related to warm air furnace heating.
*Heat losses from concrete floors laid directly on the ground.
Heating, ventilating, and air conditioning as related to steam and hot water heating.
Study of year-round performance of an air heat source heat pump in a small residence.
Summer cooling studies in a small residence.
Study of condensing and migrating moisture in relation to concrete floors laid directly on the ground.
*Man's adjustment to ambient atmospheric environmental factors of temperature and humidity.
Improvement of air distribution systems for all-year gas air conditioning.
Effect of location of air supply and exhaust openings in an air conditioned space.
Smokeless combustion of bituminous coal in hand-fired furnaces.

Iowa State College, Iowa Engineering Experiment Station — Ames, Ia. Dean J. F. Downie Smith, Division of Engineering.
Measurements of thermal conductivity of liquids.
Study of the earth as a thermal source and sink.
Heat transfer in refrigerants.
Removal of dusts from gases.
Studies of spray nozzles.

State University of Iowa — Iowa City, Ia. Dean F. M. Dawson (College of Engineering).
Model studies in radiant heating.

Kansas State College, Engineering Experiment Station — Manhattan, Kan. Dean M. A. Durland, School of Engineering and Architecture; Prof. Linn Helander, Mechanical Engineering.
*Downward projection of heated air streams.
*Radiant heating and cooling.

University of Kentucky, Engineering Experiment Station — Lexington, Ky. Dean Daniel V. Terrell, College of Engineering; Prof. Estel B. Penrod, Mechanical Engineering.
Performance of an experimental heat pump.
Theory and design of ground coils for heat pumps.
Effect of solar radiation on soil temperatures.
Development of a new type of refrigeration compressor.

University of Louisville, Institute of Industrial Research — Louisville, Ky. Dean R. C. Ernst, Speed Scientific School.
Air pollution.
Gas flow in boilers.
Pressure measurement instrumentation.

Massachusetts Institute of Technology — Cambridge, Mass. Prof. N. McL. Sage, Director, Division of Industrial Cooperation.
School of Engineering:
Interaction between shock wave and boundary layer.
Interaction of heat, mass and momentum transfer in boundary layers.
Transfer of mass, heat and momentum between two coaxial gas streams.
Acoustics Laboratory:
Development of a direct-reading loudness meter.
Sound transmission through panels and multi-layered structures.
Acoustical properties of auditoriums and theaters.

Michigan State College, Michigan Engineering Experiment Station — East Lansing, Mich. Dean Lorin G. Miller, Division of Engineering.
Hot-wire anemometer study.
*Resistance of take-off fittings in a duct system.
Hot water panel heating.
Measurement of flow from high pressure jets.

University of Minnesota, Institute of Technology — Minneapolis, Minn. Dean A. F. Spilhaus, Engineering Experiment Station.
Temperature and humidity distribution in typical homes.
Design and efficiency of weatherstripping.
Factors affecting the performance of built-up roofs.
Vapor permeability of painted surfaces.
Methods of sealing existing structures for pressurization.
Utilization of solar energy in a heat pump.
Solution of heat transfer and diffusion problems.
Development of an instrument for measuring low temperature radiation in the infrared range.
Study of flour mill dust sampling and measuring methods.
Device for continuous measurement of dust concentration in a moving air stream.
Heat transfer rates from spheres to gases.
*Solar energy as a heat source for the heat pump.
*The control of panel heating systems.

Montana State College, Engineering Experiment Station — Bozeman, Mont. Prof. H. F. Mullikin, Mechanical Engineering.
Radiant heating systems: tests of laboratory floor, cork floor coverings, heating controls, and residence use; analysis of design procedures.

University of Nebraska, Engineering Experiment Station — Lincoln, Neb. Dean Roy M. Green, College of Engineering and Architecture.
Design and construction of an aerodynamic smoke tunnel.
Heat flow from cooling fins.
Vortex ring flow in air.

University of New Mexico, Engineering Experiment Station — Albuquerque, N.M. Dean M. E. Farris, College of Engineering.
Testing of sound absorption characteristics of building materials.
Determination of overall heat transfer coefficients.
Effects of various fill materials on the heat losses from a radiant floor panel.

New York University, Engineering Research Division — New York, N.Y. Prof. Victor Gauthier and Prof. William Roberts, Mechanical Engineering.
Practicability and implications of using the heat pump in the metropolitan New York area.

North Carolina State College, Department of Engineering Research — Raleigh, N.C. Dean J. Harold Lampe.
Thermal properties of building materials useful in radiant heating.
Heat transfer through cavity masonry walls.

Northwestern University, Technological Institute — Evanston, Ill. Dr. Paul E. Klopsteg, Director of Research.
Instrumentation and psychrometric measurement in the sub-freezing temperature range.
Flow of liquid vapor mixtures through orifices and capillary tubes under varying pressure ratios.
*Noise in hot water piping systems.

University of Notre Dame, College of Engineering — Notre Dame, Ind. Prof. Marcel K. Newman, Mechanical Engineering.
Measurement of heat transfer coefficients in heat exchangers.

Ohio State University, Engineering Experiment Station — Columbus, Ohio. Dean Charles E. MacQuigg, College of Engineering.
Improved methods for measurement of fluid flow.
Development and evaluation of axial flow compressor fans.

Oklahoma A & M College, Division of Engineering Research and Experiment Station — Stillwater, Okla. Prof. Otto M. Smith, Director of the Research Foundation.
Panel heating and cooling system using water from a cooling tower as medium.

Pennsylvania State College, School of Engineering — State College, Pa. Dean H. P. Hammond, School of Engineering.
Thermal conductivity of insulating materials.
Water vapor transmission phenomena through refrigeration insulation materials.
Development of a method for testing and rating absorbent type dehumidifiers.
Study of mechanism of water vapor transmission in building constructions.
*Water vapor transmission studies in typical building constructions.
Heat transfer from coiled tubes.
Heat transfer under periodic flow conditions.

University of Pennsylvania, Towne Scientific School — Philadelphia, Pa. Prof. John A. Goff, Mechanical Engineering.
Determination of enthalpy coefficients of gases and gas mixtures by flow calorimetry

Purdue University, Engineering Experiment Station — Lafayette, Ind. Prof. H. L. Solberg, Mechanical Engineering.
Thermal conductivity of gases and liquids.
Heat transfer from vertical plates.
Research in radiant panel heating.
Research in solar heating.

Rensselaer Polytechnic Institute — Troy, N.Y. Prof. Wood T. Henry, Director of Research Activities.
Space heater development.

University of Rochester, Division of Engineering — Rochester, N.Y. Prof. Horace W. Lent, Mechanical Engineering.
The earth as a heat source for the heat pump.
Air conditioning instrumentation.
Storage system for solar heat in residential application.

Rutgers University, Bureau of Engineering Research — New Brunswick, N.J. Prof. J. D. Stett, Mechanical Engineering.
Particulate pollution of air in the New Brunswick area.

Stanford University — Stanford, Calif. Prof. Lydik S. Jacobsen, Mechanical Engineering.
Convective heat transfer coefficiency at high velocities.

Swarthmore College, Division of Engineering — Swarthmore, Pa. Prof. Samuel T. Carpenter, Civil Engineering.
Investigation of certain aspects of non-uniform fluid flow across a flat plate.

University of Tennessee, Engineering Experiment Station — Knoxville, Tenn. Dean N. W. Dougherty, College of Engineering.
Earth as a heat source for the heat pump.

A & M College of Texas, Texas Engineering Experiment Station, College Station, Tex. Dean Howard W. Barlow.
Cooling tower design and operation.

Texas A & M Research Foundation — College Station, Tex. Prof. A. A. Jakkula, Executive Director.
Feasibility of using the earth within a reasonable distance of the surface as a source of heat for a heat pump.

University of Texas, Bureau of Engineering Research — Austin, Tex. Dean W. R. Woolrich, College of Engineering, Director.
Effect of entrance conditions on heat transfer inside tubes.
Thermal conductivity of gases and liquids at various temperatures and pressures.
Heat transfer and pressure drop in shell and tube exchangers (heating).
Silica gel water vapor refrigeration in air conditioning.
Study of the effectiveness of water spray on the roof.
Thermal characteristics of walls, floors and roofs of different types of residential construction, summer and winter.
Study of room air humidity with different types of residential construction.
Study of the thermal characteristics of different types of roofing chat — Study of temperature-time response of different heating systems.
Comparison of heating costs using different types of systems.

University of Utah, Utah Engineering Experiment Station — Salt Lake City, Utah. Prof. W. J. Cope, Mechanical Engineering.
Development of a wind tunnel balance with the application of flexure pivots and electric strain gages.
Study of fan characteristics, selection, and performance using characteristic dimensions.
Heat transfer properties of composite building sections.

University of Washington, Engineering Experiment Station — Seattle, Wash. Dean Harold E. Wessman, College of Engineering, Chairman, Prof. Bryan T. McMinn, Mechanical Engineering.
Solar heat.

University of Wisconsin, Engineering Experiment Station — Madison, Wis. Dean M. O. Withey, College of Engineering.
Calibration and development of low velocity meters.
Air distribution.
Investigation of the heat pump.
Heat transfer in wetted coils.
Oil burning for heating.

Yale University, School of Engineering — New Haven, Conn. Dean Walter J. Wohlenberg, Mechanical Engineering.
Study of combustion in gaseous system with reference to those geometrical properties of turbulent gaseous system which affect the rate of combustion.

*Projects underway in cooperation with ASHVE.

New ASHVE Environment Laboratory Inaugurated

THE SOCIETY'S new Environment Laboratory, one of the most significant of the ASHVE tools for fundamental research, was officially unveiled for members, industry executives, and the press during two-day inauguration ceremonies on November 1 and 2 at the Research Laboratory in Cleveland. The much publicized and widely discussed new Environment Laboratory will be devoted to research in human comfort conditions and to the development of data for the design and installation of panel heating and cooling systems.

Prior to their visit to inspect the new facility on November 1, guests gathered in the Pine Room of the Statler Hotel for a welcome luncheon and to hear a keynote address by Cloud Wampler, president of Carrier Corp. On hand to greet guests were Society President Lauren E. Seeley; I. W. Cotton, chairman of the Committee on Research; Cyril Tasker, director of research, ASHVE Research Laboratory; P. B. Gordon,

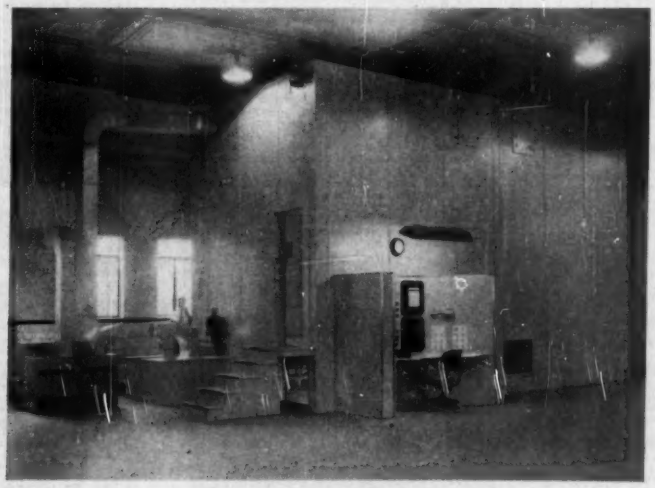
Lauren E. Seeley
Durham, N. H.

chairman of the TAC on Panel Heating and Cooling; and C. S. Leopold, chairman of the TAC on Sensations of Comfort, all of whom figured importantly in the development of the project; and other Society officers and committee members.

In his address of greeting, President Seeley stressed the great importance of the new Environment Laboratory to the profession and industry, and, in turn, to the public as a whole. From this new facility, he commented, more will be known than ever before about reactions and comfort sensations of human beings, and these discoveries will lead to new practices and a better life for all people. *We hail this new Environment Laboratory as a tremendous forward step in a vital phase of the Society research program,* he said. *It has great potentialities and possibilities for future usefulness.*

Following a short address by Mr. Cotton, who briefed the group preparatory to the inspection tour, President Seeley inroduced Mr. Wampler, who then delivered the feature address, *The Environment of Our Industry.*

Exterior of the Environment Laboratory showing instrument console, entrance to crawl space underneath stairs, and dehumidifier and duct work



Highlights of Address by Cloud Wampler

Bachrach

Cloud Wampler
Syracuse, N. Y.

Perhaps most of you know that I am not an engineer. As a matter of fact, I am a banker turned manufacturer. And a favorite wisecrack of mine is that BTU is merely "but" misspelled.

However, I have had some rather extensive exposures to members of the engineering fraternity, and, of course, this is particularly true with respect to my Carrier associates.

As I refer to these men, I cannot help but remember that six of them have served as your President. One of these was my predecessor, J. I. Lyle. The others were Paul Gant, Bill Driscoll, Thornton Lewis, Ned Stacey and, of course, Dr. Carrier. And I venture to express the opinion that the shadows of these men are very long indeed. I feel very humble as I think of the leadership that has been furnished by my associates.

My feelings are further stirred by the fact that what we are celebrating here today has a much deeper significance than even the evidence that we will see.

Certainly, the new facilities that we will inspect this afternoon are, in themselves, a wonderfully fine step forward. But the really important thing, it seems to me, is that here is still another indication that our industry is sufficiently aware of the value of fundamental research for its members to join together in planning and financing and constructing a laboratory dedicated both to our own common good and to the public welfare.

What we are saying tangibly here today, as well as in the broad research programs of this society and of our own companies, might, I think, be summed up in these words:

"Individually and collectively, we have made great progress in the past half century. However, the opportunities that lie ahead are infinitely greater than those of the past. Not only may we make our own technological improvements, but we may also apply the technological developments in other fields to the field which is ours. All told, there are many frontiers that must be explored, and still other frontiers which we cannot now even identify. Nevertheless, we intend that they shall all be explored to the end that greater and greater discoveries shall be made for the benefit of mankind."

Here I would remind you that this industry of ours is one that serves best a peaceful world. However, we have done, and we are doing, and we will do our full share when wars or threats of wars prevail.

It is unquestionably true that we have come a long way in a relatively short time. Let's take the 57-year span of this society as a measuring stick. When ASHVE was founded in 1894 the heating equipment was crude indeed compared to that of today. Air conditioning did not even exist. Mechanical refrigeration itself was relatively new. And the few scattered attempts that had been made at cooling for human comfort consisted mainly of putting chunks of ice in ventilating systems.

However, there certainly is no room for smugness on our part because of this progress. Actually, we have not advanced as far as we should have during this period. The inventive genius of our industry has been less productive than that of a number of others. But I believe completely that we will accomplish much more during the next fifty years than we have in the last.

In my opinion, we must show more daring and initiative. Let me tell you a story here for purposes of illustration. Ten years ago, when I was very new in my present job, there was a meeting in my office with some of our top technical people to discuss future objectives. I told them something like this:

"What I want from you is a room air conditioner not more than two feet wide, one foot high and 18 inches deep. It should have no moving parts, and therefore be absolutely quiet. I'd like to have it with a plug on top which you could unscrew and pour in a quart of something or other once a year, and then be sure of perfect operation for the next twelve months."

Dr. Carrier was in the room at the time, and his remark was that whatever it was that would be poured into that gadget would have to be considerably stronger than corn liquor.

Now, of course, I was shooting the moon. And no such unit is anywhere in sight, to the best of my knowledge. But who can say with any assurance that this result won't be achieved someday, and, perhaps, before too long? The point to be made here is that we must aim high and work unceasingly if we are to progress as we should.

In this connection, I was extremely interested in a recent statement made by David Sarnoff, Chairman of the Board of Radio Corporation of America, at the ceremonies marking his 45th year in radio. General Sarnoff challenged the research scientists and engineers of RCA to make three essential inventions within the next five years. One of these was an electronic air conditioner for the home that would operate with tubes — or possibly through the action of electrons in solids — and without moving parts. Among other things, General Sarnoff expressed this opinion, "I am sure you will succeed in discarding the wheels and the noise in air conditioners."

Certainly I cannot speak with the same authority in the scientific field as does General Sarnoff. However, his views and mine on this subject are identical.

Now, let's look for just a moment at what we as an industry are doing in the way of research. As indicated earlier, it is my view that we have been guilty of an error of omission in not doing more, collectively, to press our search for some of the answers we do not now have and to broaden our joint program of fundamental research.

I would like to approach this subject by means of a little simple arithmetic. And purely for purposes of illustration, I will deal only with the air conditioning and refrigeration end of the business. Please understand that there is no intention on my part of disregarding or ignoring the heating and other important segments of the industry as represented in this society. I am just taking the easiest course and, naturally, the figures for air conditioning and refrigeration were more readily available to me than others.

I believe it conservative to estimate that at least 1.5 cents of each of the sales dollars in this part of our industry is plowed back into research of one type or another. In 1950, the value of manufacturers' shipments of commercial and industrial refrigeration and air conditioning equipment was $639,000,000. And bear in mind that this is a factory level figure. At any rate, we can conclude that in this area alone the investment in research was just short of $10,000,000. To this we should add the research performed by the other great parts of our industry, research by related industries that is of direct benefit to us, and by the many schools and colleges

which have made research progress in our field. We could guess, quite plausibly, that the total research bill comes somewhere near $20,000,000 annually.

Now, except for the expenditures through schools and colleges, the great bulk of this money goes into product and process development, slanted toward improving the competitive position, sales volume and profits of the company that spends the money. And this is exactly as it should be.

However, the question I would raise directly with you is whether we are spending enough money on long-range fundamental and applied research of a type which will perpetuate and benefit the entire industry. True, some of this work is now being carried on by individual companies as part of their contribution to the future. But there are many fine companies which cannot afford to do this, nor put the proper talent to work on it, nor provide the proper atmosphere for such work — an atmosphere which should be reasonably free from commercial pressures.

All this leads very directly to the reason for our being here today. And here I would emphasize that the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS is unique among societies of its kind in that it is the only one which operates its own research laboratory.

Now for a bit of a shock. The entire program for the ASHVE Laboratory in 1952 will cost less than $200,000. Industry will contribute less than 40 percent of this sum. Consequently, at present the Laboratory is costing our industry only about one-hundredth of one percent of the sales volume of air conditioning and commercial and industrial refrigeration equipment alone, and represents only about four-tenths of one percent of the total amount invested each year in research in the field of heating, ventilating and air conditioning.

Gentlemen, I submit to you that *we should be spending a great deal more on fundamental research. And I say to you, this is not an expense. It is an investment — an investment in our own future.*

However, it is still not enough for us to say, "Here's the money — go to it!" We also must make adequate contributions of the time of our best engineering people to assure the success of the program. Good technical brains are needed on the Advisory Committee and on panels to advise as to how and where the money should be spent. And we have them!

It is good business to make these brains available. By so doing, we can be sure that research programs are kept "on the beam." Even though they must explore fundamental areas, they should be executed competently, to produce useful and practical results within a reasonable time. Also, we should be sure that the programs undertaken will be for the greatest good of the greatest number — projects that hardly could be undertaken by any of our individual companies, and which, without collective action, might remain undone.

As to value received, there simply is no question about it. I know that fundamental research sometimes seems to move very slowly. Perhaps it does. But no intelligent person can expect basic results to be achieved on a timetable basis. And you have only to look back over the years to see what extremely valuable data has come out of ASHVE research alone.

More than 30 years ago, original studies by the Society established the limits of indoor temperature and humidity for maximum human comfort in winter. Not long afterward, standards were set for summer air conditioning. Excellent work was done also on the effects upon the human body of severe environmental conditions.

Society research also resulted in design data for heating systems — capacity tables which are now universally used. Construction projects of all types have benefited greatly from the ASHVE studies into the thermal properties of common building materials, enabling a better calculation of heating and cooling loads. I will not attempt to catalogue the entire gamut of research that has been successfully undertaken by the Society, but it would be grossly unfair not to mention the fine work that has been done on cooling load calculations and room air distribution.

However, this is a day for looking ahead rather than backward. I am delighted that the new Environment Laboratory we will see this afternoon was designed from the outset, to quote an official ASHVE statement, as *a facility for research into human comfort conditions.* Certainly this is an area which will stand further exploration.

However, I have some quarrel with the official statement. It seems to me that one very important word is missing. And I am inclined to think that this word is "productivity". In any event, research must be conducted with respect to both human comfort *and productivity* if we are to realize the ultimate for our industry. Some people might prefer the word "efficiency" to the word "productivity". However, I hold that "productivity" is the better choice.

In this connection, I would hazard a guess that within the next five years — granted freedom from war or major depression — we will see more than 1,600,000 American homes enjoying either partial or complete air conditioning. But by that time it is expected that there will be 45,000,000 homes in America which will be served by electricity. And so the longer term outlook is even more encouraging, and very challenging.

You will note that I have just used the expression "partial or complete air conditioning". By "partial air conditioning" I mean largely that provided by the so-called room air conditioner. And I would like to say just a few words about this most interesting product.

It is being widely predicted that by 1957 the production of room air conditioners will reach a volume of one million a year.

Personally, I doubt this. But it could be.

My view is that it will not be unless we of this industry are smart enough to develop a unit that is less noisy, more reliable, less bulky and more attractive — to sell at less than $200. Incidentally, it's a half-ton unit that I have in mind at this price.

It is my belief that year 'round air conditioning will, in the next few years, have a profound effect upon home design. And I hold that this effect will be felt in a variety of ways, especially lower cost.

By all this talk about room air conditioners and home air conditioning, perhaps I am creating the wrong impression about what should be expected from the new ASHVE laboratory. If so, let me make a correction quickly. What we need and should expect is a broader base of fundamental knowledge. Then as this base becomes larger and more solid, it should be left to individual companies to build on it. In other words, the development of products — with full advantage taken of better fundamental knowledge — is the job of your company and of mine.

However, it seems to me that ASHVE might do some excellent work along lines that would be helpful in the field of unitary equipment, including home air conditioning. For example, it should be possible to measure the productivity of human beings after a good night's rest in an air conditioned sleeping room as opposed to after a bad night in the heat and the humidity.

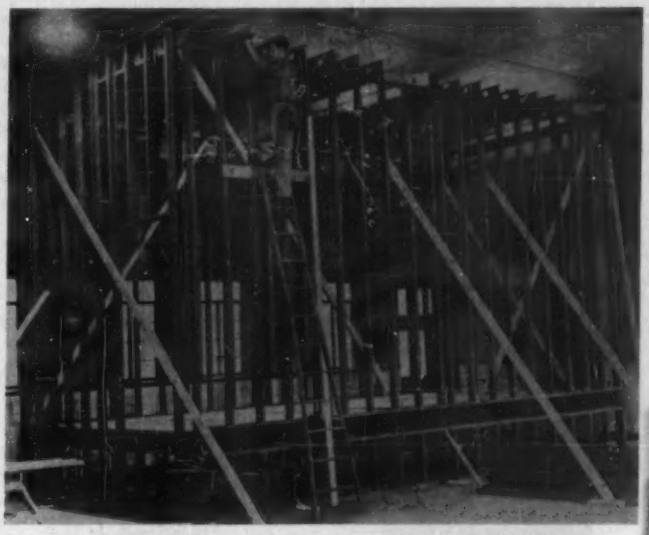
We cannot depend upon ASHVE to do the whole job even in the field of fundamental research. Others must and will help. And I would say that one of the great assets of ASHVE is its fine relationships with institutions of higher learning. Take, for example, the work being done at the University of Illinois, in cooperation with the Society, on the effects of environment upon physiological reactions. Research activities such as these are all to the good and will help us reach our objectives more soundly and more quickly.

One of the major elements of this country's greatness is freedom of initiative — freedom to explore, if you will. Also, it must be kept in mind that research, to be effective, must be a continuing process and cannot be turned on and off like a water faucet.

Because of the fine building job that has been done since the early thirties, we now have a so much better base on which to build. Our industry is really something pretty special. I know of none other that has more appeal or more promise. And I hold that our industry is bound to prosper, if for no other reason than that it is firmly founded on service to mankind — heating him in winter, cooling him in summer, promoting both his comfort and health, helping him to produce — faster, better, cheaper — an infinite number of the components of our rising standard of living.

Following Mr. Wampler's address, President Seeley turned the meeting over to a discussion of this outstanding talk and some interesting comments were contributed by A. B. Algren, Minneapolis, Minn.; R. A. Miller. Pittsburgh, Pa.; and J. C. Fitts, New York, N.Y.

At the conclusion of the discussion, the group embarked for the Research Laboratory to inspect the new Environment Laboratory, and a great deal of interest was created by the new facility and by the other ASHVE research projects under way.



Light steel framework of Environment Laboratory during construction

November 2 Program

Guests gathered in the Pine Room of the Statler Hotel on November 2 for the second day of the program inaugurating the Society's new Environment Laboratory. President Seeley presided and welcomed guests, assisted by Messrs. Cotton, Tasker, Gordon, and Leopold, and other Society officers and committee members.

In his greeting address which opened the meeting, President Seeley stated that the new Environment Laboratory was one of the Society's most vital tools for fundamental research and that it promised many new benefits to the industry, and, consequently, to the public.

He referred to an address, *Engineering with the Human Touch*, which he has made before many Society Chapters this year, to emphasize the important role the heating, ventilating, and air conditioning engineer has played, and must continue to play, in the interest of the common good.

In this address, I point to the unique relationship we enjoy, as engineers, with every man, woman, and child by virtue of the fact that our practice contributes directly to their health, comfort, and well being.

We work directly for people in their homes, schools, churches, business places, and recreational buildings. It is natural that we have investigated carefully, and must continue to investigate carefully, the behavior and reactions of people to the environment we produce. It is a big job and an important job, truly one requiring engineering with the human touch.

In conclusion, President Seeley recalled some of the Society's many contributions to the field and predicted that the new Environment Laboratory could make possible still greater advances in the future.

Following his address, President Seeley introduced I. W. Cotton, who made an interesting presentation on the subject, *Research Supplies the Answers.*

I. W. Cotton
Indianapolis, Ind.

In his address, Mr. Cotton outlined the current ASHVE research program and said that he believed the function of fundamental research was to develop dependable and accurate data and not to lap the field. As an illustration, he pointed to the procession of building materials with largely unknown characteristics that has appeared in the past few years. Accurate information about these products and correct formulae for their usage become urgently required, he said, and research goes to work to supply the answers.

Should Society research ever catch up with actual practice, Mr. Cotton continued, it could only be because the field has stopped trying new ideas. He said that he did not fear such a calamity and believes that inventiveness and courage will dominate the future.

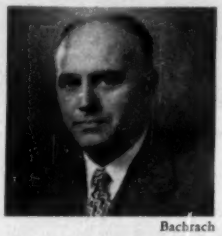
With this true, new improvements will continue to flow and research will continue to study and proclaim. Our ideal should be for research to try constantly to narrow the gap between itself and the field; but our ambition for a future of expanding accomplishment should make us hope that research never does completely catch up.

At the conclusion of Mr. Cotton's talk, President Seeley introduced the second guest speaker, P. B. Gordon,

who addressed the group on the subject, *The Need for Panel Heating Research.*

In his address, Mr. Gordon stated that most panel heating applications in the past have been by empirical methods. These methods proved inadequate, and, consequently, there was a need for reliable design data. In response to this need, the Society designed and built the new Environment Laboratory.

The new room will now provide the full-sized test apparatus needed to expand the present program and to handle heat flow analysis of this type, Mr. Gordon said. Touching upon



Bachrach

P. B. Gordon
New York, N. Y.

some of the methods now employed to obtain data, he commented that field studies, although important, are not sufficient and are difficult to control. In respect to analysis and analogues, he recognized that these are useful but are not fully adequate to develop the needed information. *The new laboratory will make possible a space that can be maintained with any combination of interior temperatures.*

At the conclusion of Mr. Gordon's address, President Seeley introduced the third and final speaker of the meeting, C. S. Leopold, who made a presentation, titled, *The Challenge of Environment Studies.*

C. S. Leopold
Philadelphia, Pa.

In his address, Mr. Leopold explained that the function of the TAC on Sensations of Comfort was to direct studies of psychological aspects of comfort. The main purpose of this committee's work, he said, is to study the subjective reaction of people to their thermal and atmospheric environment indoors. *Our responsibility is to find out how people think they feel in a given environment.*

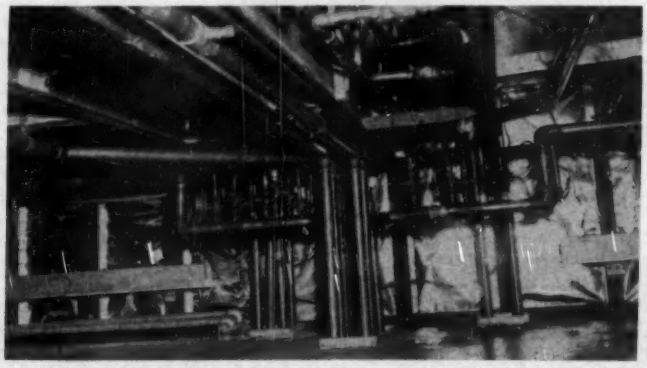
Mr. Leopold then went on to say that there are many people who stress the importance of mean radiant temperatures and that there are still others who emphasize asymmetry of radiation. Obviously, he commented, both are important and both will have to be investigated. *There are reasons to believe that the same findings will not apply to people seated or engaging in any light work, and for people standing and engaged in manual work, even such light activity as woodworking with hand tools.*

Mr. Leopold revealed that one of the first tasks of the TAC on Sensations of Comfort will be to recheck the comfort data for people acclimated to winter conditions. For this study, he disclosed, the mean radiant

Cyril Tasker
Cleveland, Ohio

temperature will be established as approximately equal to air temperature, as was done in the original ASHVE studies. These data confirmed or modified, but surely amplified, he added, will then provide a firm starting point for further studies. *We can then proceed to evaluate*

Crawl space beneath Environment Laboratory for access to piping and wiring



changes in mean radiant temperature, both symmetrical and asymmetrical.

Mr. Leopold concluded by saying that the new environment laboratory affords the opportunity of appraising radiant effects under much better control than was possible within previous experimentations. *In the new laboratory,* he said, *the surface temperature of four walls can be separately controlled. In addition, portions of these surfaces can be maintained at different temperatures. We can, for example, simulate a condition in which someone is sitting beside a large window, with or without a radiator beneath it. We can check the effect of a hot or cold ceiling and the effect of a warm or cold wall. What's more, we will not have to wait for the weatherman to give us conditions for testing.*

At the conclusion of Mr. Leopold's address, the meeting was adjourned for luncheon. Following luncheon, the group travelled to the Research Laboratory where Cyril Tasker described the new facility and provided an outline of the program that it will make possible. As on the previous day, guests displayed considerable interest in the new Environment Laboratory and in the other ASHVE research projects currently in progress.

Dr. Keeton Retires From University of Illinois

Dr. Robert W. Keeton, distinguished for his academic contributions to Chicago medicine for more than 40 years, and a member of the Society, was honored on October 4 at a dinner at the Furniture Club of America, Chicago.

R. W. Keeton

The occasion was prompted by his retirement as professor and head of the Department of Internal Medicine at the University of Illinois, a position which he has held since 1933. In that capacity, he directed the teaching and research activities of some 225 physicians who hold faculty appointments in the department. In addition, Dr. Keeton guided physiological research carried on at the University as a cooperative project with the Society.

More than 400 colleagues, former students, and friends paid tribute to Dr. Keeton at the dinner. Speakers were Dr. Anton J. Carlson, professor of physiology, emeritus, at the University of Chicago, and the following from the University of Illinois: Dr. A. C. Ivy, Provost Coleman R. Griffith, Dr. Hugh McGuigan, who is professor of pharmacology, emeritus, and Dr. Stanley W. Olson. Master of ceremonies was Dr. LeRoy H. Sloan.

Highlight of the evening was the presentation of a *Festschrift* to Dr. Keeton. The commemorative volume consisted of 36 original scientific papers written by his associates. The book was published by Charles C. Thomas, Springfield.

Dr. Keeton, 68, has been associated with the University of Illinois continuously since 1925. Prior to that time, he taught at Albany Medical College, Northwestern University, James Millikin University, in Texas, and also at the University of Illinois.

He is the author of more than 125 major publications and has written numerous papers for presentation at Society meetings and for inclusion in the JOURNAL and TRANSACTIONS. His interests have concerned particularly the fields of diabetes, nausea and vomiting, gastric physiology, nutrition, obesity, liver disease, the response of the individual to environmental changes, metabolism, and studies on convalescence under widely differing conditions.

Dr. Keeton is a member of many medical and scientific societies, and has served as president of the Chicago Society of Internal Medicine and the Central Interurban Club. He has been active in the affairs of the National Board of Medical Examiners.

Dr. Keeton received the doctor of medicine degree from Northwestern University in 1916. He previously had received undergraduate degrees from Cumberland University and the University of Chicago, and the master of science degree from the University of Chicago.

SAYS CO-OP GRADUATES ARE FULL YEAR AHEAD

Graduates from cooperative courses are a full year ahead in industrial know-how over engineering graduates from conventional courses, H. B. Richmond, chairman of the board, General Radio Co., Cambridge, Mass., said recently. Mr. Richmond's advocacy of the cooperative system was made in an address before the *Engineers Council for Professional Development* at the group's 19th Annual Meeting in Boston, Mass. The *ECPD* is a conference of engineering societies representing 130,000 professional engineers in the United States and Canada.

The reason for their advantage, Mr. Richmond claimed, is that such graduates are *housebroken* for industry by their part-time experience as employees during their college years.

Mr. Richmond said he spoke from experience because he actively employs cooperative students in his plants. He scouted the idea that the cooperative program was an extension of the old apprenticeship program. *The philosophy of collegiate education,* he continued, *is sufficiently advanced and different from the basic old-time apprenticeship system to make it a new entity.*

Technical Program Announced For 58th Annual Meeting

January 28-30, 1952

PRESENTATION of technical papers at four sessions and a symposium on Industrial Atmospheres will feature the Society's 58th Annual Meeting in St. Louis, January 28-30, 1952, it was announced recently by Pres. Lauren E. Seeley. With the selection of papers by the Program and Papers Committee, the program is virtually complete, Bruce L. Evans, chairman of the Committee on Arrangements for the St. Louis Chapter, said in reminding members that there is not too much time left in which to make plans.

The first technical session will be held on Monday, January 28, at 2:30 p.m., with the following papers to be presented: Venting Hot Water Heating Systems, by F. E. Giesecke; Self-Charging Electrostatic Filters, by H. A. Endres and W. T. Van Orman.

The second technical session is scheduled for Tuesday, January 29, at 9:30 a.m., and these papers will be given: A V-Wire Direction Probe, by H. B. Nottage, J. G. Slaby and W. P. Gojsza; Radiant Energy Emission of Atmosphere and Ground—A Design Factor in Heat Gain and Heat Loss, by G. V. Parmelee and W. W. Aubele; Isothermal Ventilation-Jet Fundamentals, by H. B. Nottage, J. G. Slaby, and W. P. Gojsza.

The third session, set for Tuesday, January 29, at 2:00 p.m., will be devoted entirely to the symposium, Control of Industrial Atmospheres, W. N. Witheridge acting as moderator. Speakers and their subjects are: H. A. Mosher, Integration of Process and Human Requirements; A. T. Waideloch and W. Hunting, Controlled Atmospheric Conditions in Industrial Plants — Effect on Architecture and Plant Layout; R. P. Warren, Conversion of Requirements into Practical Equipment for Ventilation and Air Pollution Control; R. A. Kehoe, M.D., Appraisal of Results by Occupants and the Community — Occupational Health and Air Pollution.

The fourth session will be held on Wednesday, January 30, at 9:30 a.m., and these papers will be presented: Gas is an Important Factor in Thermal Conductivity of Most Insulating Materials, by F. B. Rowley, R. C. Jordan, C. E. Lund, and R. M. Lander; Thermal Performance of Frame Walls, by G. O. Handegord and N. B. Hutcheon; Physiological Adjustments of Clothed Human Beings to Sudden Changes in Environment — First Hot Moist and Later Comfortable Conditions, by F. K. Hick, M.D., Tohru Inouye, R. W. Keeton, M.D., Nathaniel Glickman, and M. K. Fahnestock.

The fifth and final session is to be a warm-air heating session and will be held on Wednesday, January 29, at 2:00 p.m. These papers are scheduled for presentation: Warm-Air Perimeter Heating, Part II — Temperature Drop in Ducts Embedded in Concrete Floors, by J. R. Jamieson, R. W. Roose, S. Konzo, and H. T. Gilkey; Warm-Air Perimeter Heating, Part III — Heat Losses from Floor Slab, by J. R. Jamieson, R. W. Roose, and S. Konzo; Performance of a Warm-Air Radial-Feeder Perimeter-Loop System in a Residence, by M. E. Childs, R. W. Roose, and S. Konzo.

Ample opportunity for fellowship and diversion will be afforded by an outstanding program arranged by the Committee on Arrangements of the St. Louis Chapter. The social program arranged thus far will be launched officially on Monday morning when everyone will embark on an inspection trip to see various points of interest in the Mound City. At noon, all will gather in the Statler Hotel for a Welcome Luncheon, and an address, *Engineering a Pennant Winner*, by William (Bill) Veeck, president and owner of the St. Louis Browns, and formerly president and owner of the Cleveland Indians, winners of the 1948 American League pennant and world series. In the afternoon, while the technical session is being held, the ladies will see an unique and highly interesting exhibit of shoes dating from revolutionary times to the present. In the evening, all will meet in the Boulevard Room of the Jefferson Hotel for a *Meet Me in St. Louis Party* which will feature dinner, entertainment, and dancing.

On Tuesday morning, while the technical session is in progress, the ladies will travel to the Park Plaza Hotel for a luncheon and Fashion Show featuring the latest in gowns, coats, and furs. In the evening, all who do not have committee meetings scheduled will gather to see two fine films, *Prairie Wings* and *Sunrise Serenade*. On Wednesday evening, the meeting will reach its climax in the Gold Room of the Jefferson Hotel when all join for the traditional banquet.

Hotel reservations already received indicate one of the most heavily attended meetings in Society history. In light of this heavy flow of early reservations, members are urged to return their requests for hotel accommodations as soon as possible, to assure reservations of their first choice. These reservations should be sent to: Hotel Convention Bureau, ASHVE, Room 406, 911 Locust St., St. Louis, Mo.

The St. Louis Chapter urges every member to come to *the City Surrounded by the United States* for the 58th Annual Meeting. No matter where the member may live, the Chapter avers, he will find it a short trip and most certainly the right trip for a meeting that will be second to none in technical value and good fellowship.

PROGRAM 58TH ANNUAL MEETING

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Hotel Statler — St. Louis, Mo. — Jefferson Hotel

January 28-30, 1952

Sunday—January 27

10:00 a.m. Council Meeting (Hotel Statler)
1:30 p.m. REGISTRATION (Hotel Statler)
2:00 p.m. Motor Tour of City
2:00 p.m. to 5:00 p.m. Welcome Tea

Monday—January 28

8:30 a.m. REGISTRATION (Hotel Statler)
9:30 a.m. Chapter Conference Committee Meeting
9:30 a.m. Inspection Trips
12:30 p.m. WELCOME LUNCHEON (Hotel Statler)
Speaker: William (Bill) Veeck
Subject: Engineering A Pennant Winner
2:30 p.m. Shoe Styles for Ladies (Hotel Statler)
2:30 p.m. FIRST TECHNICAL SESSION (Hotel Statler) Pres. Lauren E. Seeley presiding
Greetings by L. L. Hamig, President, St. Louis Chapter
Response by President Seeley
Reports of Officers
Amendments to By-Laws, H. E. Sproull, Chairman Charter & By-Laws Committee
Venting Hot Water Heating Systems, by F. E. Giesecke
Self-Charging Electrostatic Filters, by H. A. Endres and W. T. Van Orman
3:00 p.m. Ladies Tea with Entertainment (Hotel Statler)
7:00 p.m. "Meet Me in St. Louis" Party — Dinner — Entertainment — Dancing — Boulevard Room — Jefferson Hotel

Tuesday—January 29

9:00 a.m. REGISTRATION (Hotel Statler)
9:30 a.m. SECOND TECHNICAL SESSION (Hotel Statler)
First Vice Pres. Ernest Szekely presiding
Report of Committee on Research, I. W. Cotton
A V-Wire Direction Probe, by H. B. Nottage, J. G. Slaby and W. P. Gojsza
Radiant Energy Emission of Atmosphere and Ground: A Design Factor in Heat Gain and Heat Loss, by G. V. Parmelee and W. W. Aubele
Isothermal Ventilation-Jet Fundamentals, by H. B. Nottage, J. G. Slaby, and W. P. Gojsza
*The A.S.H.V.E. Environment Laboratory, by Cyril Tasker
11:30 a.m. Buses Leave for Ladies Luncheon and Style Show — Park-Plaza Hotel
2:00 p.m. THIRD TECHNICAL SESSION (Hotel Statler) Pres. Lauren E. Seeley presiding
Symposium — *Moderator*: W. N. Witheridge, Chairman, TAC on Industrial Ventilation, Detroit, Mich.
Subject: CONTROL OF INDUSTRIAL ATMOSPHERES
1. H. A. Morher, Rochester, N.Y.; Integration of Process and Human Requirements.
2. A. T. Waideloch and W. Hunting, Cleveland, Ohio: Controlled Atmospheric Conditions in Industrial Plants — Effect on Architecture and Plant Layout.
3. R. P. Warren, Buffalo, N. Y.; Conversion of Requirements into Practical Equipment for Ventilation and Air Pollution Control.
4. R. A. Kehoe, M.D., Cincinnati, Ohio; Appraisal of Results by Occupants and the Community — Occupational Health and Air Pollution.
Discussion period
Summary by Moderator
Motion picture by the University of Michigan on Principles of Exhaust Ventilation — presented by K. E. Robinson, Lansing, Mich.
6:30 p.m. PAST PRESIDENTS' DINNER
6:30 p.m. Nominating Committee Meeting
8:00 p.m. Movies: Prairie Wings and Sunrise Serenade

Wednesday—January 30

9:00 a.m. REGISTRATION (Hotel Statler)
9:30 a.m. FOURTH TECHNICAL SESSION (Hotel Statler)
Second Vice Pres. Reg. F. Taylor presiding
Gas is an Important Factor in Thermal Conductivity of Most Insulating Materials, by F. B. Rowley, R. C. Jordan, C. E. Lund, and R. M. Lander
Thermal Performance of Frame Walls, by G. O. Handegord and N. B. Hutcheon
Physiological Adjustments of Clothed Human Beings to Sudden Changes in Environment: First Hot Moist and Later Comfortable Conditions, by F. K. Hick, Tohru Inouye, R. W. Keeton, N. Glickman, and M. K. Fahnestock
10:30 a.m. Ladies' Bus Tour — Points of Interest in St. Louis terminating at the Art Museum for Luncheon at 1:00 p.m. (Return to Jefferson and Statler Hotels at 2:30 p.m.)
2:00 p.m. FIFTH TECHNICAL SESSION (Hotel Statler) Pres. Lauren E. Seeley presiding
Warm Air Perimeter Heating, Part II — Temperature Drop in Ducts Embedded in Concrete Floors, by J. R. Jamieson, R. W. Roose, S. Konzo, and H. T. Gilkey
Warm Air Perimeter Heating, Part III — Heat Losses From Floor Slab, by J. R. Jamieson, R. W. Roose, and S. Konzo
Performance of a Warm Air Radial-Feeder Perimeter-Loop System in a Residence, by M. E. Childs, R. W. Roose, and S. Konzo.
Installation of Officers
Adjournment
4:30 p.m. Committee on Research Organization Meeting
7:00 p.m. ANNUAL BANQUET (Gold Room — Jefferson Hotel)
Speaker: Ralph Carney, Wichita, Kan.
Subject: New Strength for America
Presentation of Past President's Emblem to Dean Lauren E. Seeley
Presentation of F. Paul Anderson Medal

Thursday—January 31

9:30 a.m. Council Meeting (Hotel Statler)

*To be presented by title

Addresses by James and Lockhart Open 45th Season for Illinois Chapter

Tremendous strides have been made in recent years toward the improved design and operation of hot water heating systems. Higher and

John W. James stresses importance of proper safety equipment on boilers

higher water temperatures have been used, and today it is commonplace to design for radiator, convector, and baseboard temperatures of 215 F. Operating characteristics of these systems, quite different from those of gravity hot water heating jobs, were described to members of the Illinois Chapter at its October 9 meeting in the M and M Club, Chicago, Pres. G. W. Bornquist presiding. In the first of two feature addresses inaugurating the Chapter's 45th season, John W. James, vice president in charge of research, McDonnell & Miller, Inc., Chicago, traced the development of the present day system from the earlier gravity type open system. He emphasized the importance of providing relief valves to perform a function similar to that of pop safety valves on steam boilers, mentioning that the 1949 edition of the *ASME* Low Pressure Heating Boiler Code states that all hot water heating boilers shall be provided with National Board of Boiler and Pressure Vessel Inspectors tested and rated hot water relief valves bearing the *ASME* letter symbol *V* on the nameplate. This means that the valve must be selected so that the nameplate rating on the valve, expressed in Btu per hour, matches the gross output of the boiler.

George W. Bornquist, president of the Illinois Chapter, opens the group's 45th season

Mr. James also said that, when a relief valve functions, large quantities of water and steam may be discharged so that a low water condition results. For this reason, a low water cutoff or water feeder is used.

H. A. Lockhart, chief engineer, Bell & Gossett Co., Morton Grove, Ill., described the problems encountered in designing forced hot water heating systems for multi-story buildings. Stating that a pressure of 30 psi and a temperature of 250 F are normally the legal limits for hot water heating systems, he used diagrams to show that in many installations the static head on the boiler left insufficient leeway for pressure rise due to temperature increase and surging of the circulating pump.

For high buildings, Mr. Lockhart recommended that the system be divided into vertical zones with converters for each zone. If a steam boiler is used, the converters would be of the steam to water type, with pumps used to circulate the heating water throughout the various zones.

H. A. Lockhart discusses design of forced hot water jobs for multi-story buildings

Rather than operate the boiler under high pressure code requirements, he suggested the use of a high pressure-low pressure boiler where possible. This type of boiler is used to heat water at pressures up to 160 psi, but is not permitted to heat the water to temperatures higher than 250 F. This type of installation would utilize water to water converters and could be operated under low pressure heating boiler code requirements.

MARLEY ANNOUNCES WASHINGTON OFFICE

The Marley Co., Inc., has opened an engineering service office in Washington, D.C., it was announced recently. The office is located in the Wyatt Building at 777 Fourteenth Street, N.W.

Don Cousins, formerly associated with the engineering and sales department of the company in Kansas City, has been named manager of the new office.

Summary of Chapter Meetings*

• *ATLANTA*—September 10, 1951. Following dinner and a social hour, the business meeting was called to order by Pres. E. K. Jamison in the Harris Tea Room. The minutes of the previous meeting were read and approved. S. W. Boyd, chairman of the Chapter's code committee, reported that the Heating and Ventilating Code Committee for the City of Atlanta, consisting of 12 representative members, with M. W. Wise acting as chairman, had been appointed by the Mayor. He announced that one meeting had been held to date, and that approximately 20 associations were being polled to get their ideas on code revisions.

The program for the evening consisted of a panel discussion on *Plans and Specifications and their Preparation*. The panel consisted of the following men: Warren Armistead, architect, L. L. Barnes, contractor, H. K. McCain, consulting engineer, Gene Clary, manufacturer's agent, and President Jamison, acting as moderator. After each member of the panel had expressed his personal views regarding the responsibility of his professional group in the preparation of plans and specifications, the panel answered questions from the floor. Attendance 45.

• *BALTIMORE*—October 17, 1951. Prior to the regular monthly meeting of the Chapter, a board of governors meeting was held, with Dean Lauren E. Seeley, president of the Society, attending. Various items of Chapter business were discussed, and at the conclusion of the meeting, there was an hour-long informal discussion.

The regular meeting was called to order by Pres. W. P. Flanigan, following dinner. Announcements concerning the inauguration of the new Environment Laboratory in Cleveland, on November 2, and the forthcoming Annual Meeting in St. Louis were made.

Dean Seeley, College of Technology, University of New Hampshire, Durham, N.H., was then presented. Dean Seeley, who spoke on the subject, *Engineering with a Human Touch*, began by giving a brief history of the development of heating and ventilating. He then went on to relate the experiments he had carried on, using himself as the subject, to determine the effects of temperature and humidity variations on the nasal passage. Some of the conclusions reached were that the nasal passage is an effective air conditioning device and that the air you breathe is warmed and humidified almost completely in the nasal passage, with very little heat and moisture added in the lungs. The only time the temperature of the air reaches body temperature is when the incoming air is above body temperature and the air is not quite saturated. Further, it was noted that the membranes could become completely devoid of moisture, thereby exposing the tissues in the nasal passage to infection. Dean Seeley concluded his talk by warning that engineers might very likely be studying psychology next, or any other subject which would further knowledge of human behavior. Attendance 50. Attendance ratio 0.49.

• *CINCINNATI*—October 2, 1951. Pres. J. J. Bechtol called the meeting to order at 7:45 p.m. at Engineering Society Headquarters, and the minutes of the May 24 meeting were read and approved. B. R. Byard of the program committee announced that J. W. James, vice president of research, McDonnell & Miller, Inc., Chicago, would speak at the November meeting, and that Fred Smith of Powell Valve Co. would be the guest speaker at the December meeting. President Bechtol added that Dean Lauren E. Seeley, president of the Society, would attend the November meeting and would give a coffee talk. H. E. Russell discussed the plans involving the proposed inspection trip through the Armco Rolling Mills at Middletown, scheduled to precede the January meeting.

A brief discussion period on Chapter business then followed, during which the following items were brought up: (1) transportation to St. Louis for the Annual Meeting in January, (2) study of various sections of the new Ohio State Building Code, and (3) the opening of the new Environment Laboratory at Cleveland on November 2. H. E. Sproull, treasurer of the Society, reported on the Semi-Annual Meeting in Portland, commenting on the large attendance.

The meeting was then turned over to the speakers of the evening, J. R. Delaney of Consolidated Gas and Electric Co., C. F. Hardy of *Appalachian Coal Institute*, and J. C. Donato of Ohio Oil Co. The subject for discussion was *Availability of Fuels*, with Mr. Delaney speaking on gas, Mr. Hardy on coal, and Mr. Donato on oil. Attendance 42. Attendance ratio 0.28.

• *CINCINNATI*—September 12, 1951. The meeting was held at the Clovernook Country Club, and dinner was served at 6:30 p.m. Pres.

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

J. J. Bechtol made a few opening remarks, welcoming both members and guests. As this was not a regular monthly meeting, there was no business conducted, and the program was turned over to Pinkney Varble, chairman of the entertainment committee. Mr. Varble did an excellent job in making a lively and entertaining affair out of awarding the golf prizes and door prizes.

Members and guests then adjourned to the social room for an evening of fun and fellowship. Attendance 64. Attendance ratio 0.35.

• *DELTA*—October 9, 1951. Members and guests met for dinner in the Trophy Room of the New Orleans Athletic Club. The business meeting was called to order by Vice Pres. Walter Cooke. Members introduced themselves and their guests, and the minutes of the September 11 meeting were read and approved.

Vice President Cooke then read a letter from A. V. Hutchinson, executive secretary, regarding the formal opening of the Society's new Environment Laboratory at Cleveland on November 2. It was pointed out that all Society members were invited to attend. Reports were given by the following: H. N. Stall—attendance committee; L. R. Maxwell—entertainment committee; T. J. Jenny—publicity committee; and C. V. Bankston—treasurer's report. Vice President Cooke mentioned the one-day program being sponsored by the Southwest Texas Chapter in San Antonio, and appointed a committee consisting of Mr. Maxwell and L. C. Burkes to consider a similar meeting in New Orleans.

Mr. Stall introduced the speaker of the evening, D. L. Morris, assistant to the chief engineer, Freeport Sulphur Co., who spoke on *Sulphur Mining on the Gulf Coast.* Supplementing Mr. Morris' discussion, a technicolor movie of actual sulphur mining operations was shown. Attendance 23. Attendance ratio 0.21.

• *DELTA*—September 11, 1951. The subject for the first meeting program for the season was *Air Conditioning of The California Building.* Preceding the business meeting, members made a tour of the building, including an inspection of the air conditioning system.

The tour was followed by dinner at the New Orleans Athletic Club, after which the business meeting was called to order by Pres. Theodore Offner at 7:30 p.m. A brief period devoted to Chapter business was concluded, and the program for the evening began.

The speaker of the evening was C. B. Gamble, partner, Cary B. Gamble & Assocs., New Orleans. Mr. Gamble, in speaking on the air conditioning system installed in the California Building, discussed: (1) the Roof Apparatus Room, (2) vertical air distribution, and (3) absorption refrigeration equipment. Mr. Gamble's presentation was accompanied by slides. Attendance 60. Attendance ratio 0.45.

• *GOLDEN GATE*—October 4, 1951. Pres. T. J. Janes called the meeting to order at 7:35 p.m. at the Engineers Club. Members introduced themselves and their guests, and the minutes of the June 7 meeting were read and approved. T. J. White, program chairman, announced that the November meeting would feature a film on the subject, *Construction and Operation of High Pressure Boilers,* made available through the courtesy of the Babcock and Wilcox Co., and that the December meeting would be a Christmas dinner-dance.

A. J. Hess, president, Hess-Greiner & Polland, Los Angeles, Calif., was the speaker of the evening. Mr. Hess spoke on the subject, *High Temperature Hot Water Heating Systems,* giving a resume of the development of hot water heating since 1900. Mr. Hess also described a large, one-pipe industrial heating installation in an aircraft plant in Los Angeles. Attendance 66.

• *IOWA*—October 16, 1951. A social hour and dinner preceded the business meeting, which was called to order by Pres. C. H. McGuiness at 7:45 p.m. The minutes of the previous meeting were read and approved, and members and guests were introduced. President McGuiness appointed new personnel for the following committees: *membership*—B. A. Schwirtz, *chairman,* G. J. Kraai, D. E. Schroeder; *auditing*—W. E. Hainline, *chairman,* W. E. Petersen; *legislative*—Perry LaRue, *chairman,* J. F. Sandfort, D. C. Murphy; *attendance*—W. K. McDonald, *chairman,* C. B. Campbell.

The speaker of the evening was L. P. Hanson, vice president in charge of sales, United States Air Conditioning Corp., Minneapolis, Minn., who spoke on the subject, *Centrifugal Fans.* In addition, he provided some interesting information on Navy ventilating requirements and special purpose equipment. The address, which was reinforced with slides, was extremely interesting and well received, according to reports. Attendance 35.

• *KANSAS*—October 2, 1951. Pres. R. F. Bauer called the meeting to order in the East Room of the Allis Hotel, Wichita. The minutes of the September meeting were approved with slight change, and H. L. Stevens reported on the Chapter By-Laws and Operational Guide. J. W. Jenner, chairman of the legislative committee, gave a report on the proposed air conditioning code. A discussion was then held concerning a meeting place and meeting date for the Chapter. A suggestion was made that the meetings be held the first Tuesday of the month, so that programs could be coordinated with the Kansas City Chapter.

Vice Pres. O. P. Bullock spoke briefly on reinvestment of personal funds in the engineering field. Vice President Bullock then introduced M. I. Levy, president, Viking Air Conditioning Corp., Cleveland, Ohio. Mr. Levy spoke on *Perimeter Warm Air Heating,* and the talk was illustrated with slides. Attendance 24. Attendance ratio 0.28.

• *KANSAS*—September 10, 1951. Pres. R. F. Bauer called the meeting to order and the minutes of a special June meeting concerning the Chapter's Charter and By-Laws were read. President Bauer announced that R. F. Jamison would resign as treasurer to serve with the United States Navy. A vote of thanks was extended to Mr. Jamison for the fine job he has done as treasurer, and H. D. Speyer was appointed as the new treasurer.

The program for the evening consisted of a discussion on a new air conditioning code for the City of Wichita, with O. P. Bullock acting as chairman. E. G. Fahnestock was called on to explain the work of air conditioning contractors in connection with the city code. Mr. Bullock then introduced the following city officials: Messrs. Smith, McCraig, Lavelle, and Fisher. They spoke about their work relative to air conditioning. A general discussion of the subject then followed.

J. W. Jenner moved that a new committee be formed to write a new air conditioning code and report to the Chapter in 30 days. The motion was seconded and passed, and Mr. Fahnestock moved that Mr. Jenner be made chairman of the committee and that the old committee be disbanded. Attendance 29. Attendance ratio 0.28.

• *KANSAS CITY*—October 1, 1951. Members and guests met at the Wishbone Restaurant in Kansas City, Mo., where Pres. C. W. Schumacher called the meeting to order at 7:35 p.m. Following reading and approval of the September minutes, G. F. Hellmer announced that the November meeting would feature a panel discussion on boilers. T. I. Harriman suggested that reservations be made as soon as possible for the Chapter's social on October 19. President Schumacher read the announcement inviting members to attend the opening of the Society's new Environment Laboratory in Cleveland on November 2, and a report from the treasurer followed.

J. R. Scherrer, Jr., introduced the speaker of the evening, M. I. Levy, president, Viking Air Conditioning Co., Cleveland, Ohio, who spoke on the subject, *Perimeter Warm Air Heating*. Attendance 82. Attendance ratio 0.32.

• *MASSACHUSETTS*—October 16, 1951. A board of governors meeting was held immediately preceding the dinner and social hour, held in the Campus Room of the M.I.T. Graduate House. The business meeting was called to order by Pres. John Bonner, and the first order of business was the reading and approval of the minutes of the previous meeting and the treasurer's report. This was followed by a discussion of plans for a joint meeting with the Massachusetts Section of the *American Society of Refrigerating Engineers* in December.

Vice Pres. G. B. Torrens, who is also program chairman, then introduced A. C. Steele, technical advisor, Revere Copper and Brass Co., speaker of the evening. Mr. Steele spoke on *Radiant Heating*, and the talk was followed by a question and answer period. Attendance 65. Attendance ratio 0.27.

• *MEMPHIS*—September 17, 1951. The meeting was called to order in the King Cotton Hotel by Pres. R. E. Larkin. Following the introduction of members and guests, the minutes of the previous meeting were read and approved. J. B. Lammons, reporting for the auditing committee, announced that the books were in good order. After some discussion, it was moved that the Chapter employ an auditor to set up the books and that all Chapter bills be paid by check. President Larkin announced the committee appointments made by the board of governors. G. C. Burr, meetings chairman, announced that the November meeting would be rescheduled to coincide with the arrival of the Society's President, Dean Lauren E. Seeley.

The program for the evening consisted of a panel discussion on the subject, *Engineer-Contractor Relationship*. The panel, consisting of W. E. Thorpe, G. C. Burr, and A. T. Bevil, all consulting engineers, did an excellent job, and several good points were brought out in the question and answer period which followed the panel discussion. Attendance 28.

• *MONTREAL*—October 15, 1951. The meeting was called to order in the Berkeley Hotel at 6:30 p.m. by Vice Pres. W. G. Hole. The minutes of the May meeting were read and approved. J. L. Knight reported on the Semi-Annual Golf Tournament held at the Grovehill Country Club on September 21, announcing that J. C. Hennesey was the winner of the Montreal Chapter trophy; Arthur deBreyne had low gross for members; and William Isaacs had low gross for guests. Mr. Knight added that Mr. Isaacs had recently applied for admission into the Society. D. L. Lindsay submitted the treasurer's report, stating that the Chapter was in good financial condition. A letter from the Ottawa members was then read. It extended an invitation to Montreal Chapter members to attend a meeting on October 23 for the purpose of discussing the formation of an Ottawa Chapter.

F. A. Hamlet, former Council member, introduced the speaker of the evening, J. W. James, vice president in charge of research, McDonnell & Miller, Inc., Chicago, Ill., who gave an excellent talk on hot water heating and its development up to date. Attendance 78.

• *NEBRASKA*—October 9, 1951. Pres. K. E. Martin called the meeting to order at 6:45 p.m. in the Hotel Castle, Omaha. The announcement regarding the opening of the new Environment Laboratory in Cleveland on November 2 was then read. President Martin announced that a survey indicated that the present meeting night, the second Tuesday of each month, was the most satisfactory. He stated that the December meeting would be held on December 4, the first Tuesday of the month, however, so that Pres. Lauren E.

Seeley could arrange to attend and deliver his address on *Engineering with a Human Touch.*

W. B. Howard then introduced E. F. Rottman, Jr., of the York Corp., who presented an interesting lecture illustrated by slides. Mr. Rottman's talk covered the design, construction, and application of centrifugal refrigeration units. Attendance 22.

• *NEW YORK*—October 15, 1951. Pres. Ernst Graber called the meeting to order in the Building Trades Club, New York City, and the minutes of the previous meeting were read and approved.

Among business covered was the announcement that 12 new members had joined the chapter since the last meeting. They are: Abraham Axelrod, R. G. Capron, L. D. Carr, W. T. Kane, Manfred Moses, K. A. Myers, J. F. O'Brien, Jr., J. W. Stribling, Norman Unger, R. H. Wolin, H. H. Yousoufian, and E. J. Zahorak.

Following the introduction of these new members, President Graber announced that the Chapter's annual Christmas Party would be held on December 17 at the Building Trades Club. He also disclosed that a communique had been received from Society Headquarters which cordially invited every member to visit the ASHVE Research Laboratory in Cleveland on November 2 for the purpose of viewing the newly completed Environment Laboratory.

D. J. Whealton, program chairman, then introduced the speaker of the evening, H. W. Alyea, development and field engineer, Johnson Service Co., Milwaukee, Wis., who provided an interesting address on the subject, *Automatic Controls and Their Application.*

Mr. Alyea began his talk by describing the functions and design principles of various types of controls. He then went on to illustrate how controls were applied to obtain proper balance between indoor and outdoor air and how they were installed to obtain satisfactory velocities under varying load conditions.

Mr. Alyea gave special attention to unit ventilator control, showing by temperature charts obtained from tests, the beneficial effect of a submaster thermostat located within the unit and reset by the room thermostat. He also cited the control of a large installation by means of a velocity control at a typical unit to illustrate the possibility of obtaining satisfactory control of air distribution in a relatively simple manner. Attendance 140. Attendance ratio 0.25.

• *NORTH CAROLINA*—September 28, 1951. Pres. R. O. McGary called the meeting to order in the Starmount Country Club, Greensboro, N. C., and the minutes of the April and June meetings were read and approved.

Included in Chapter business covered was an announcement by W. D. Graham, Jr., membership chairman, that 19 new members of the Society had been contacted and 4 had already joined the Chapter. They are: G. H. Ficken, J. G. Dudley, J. I. Westervelt, and J. V. Andrews, Jr.

Before turning the meeting over to J. W. Barr, program chairman, President McGary touched upon some of the outstanding work being accomplished by ASHVE Research and stressed the urgent need for its financial support. As a result, a motion was made by Arvin Page and seconded by L. F. Lawrence, Jr., that the Chapter appropriate $200.00 from its funds for the ASHVE Research Laboratory. The motion was adopted.

President McGary then appointed the following Chapter members to comprise a nominating committee for the coming year: C. Z. Adams, *chairman,* C. A. McKeeman, J. E. Hart, R. B. Crosland, Jr., and J. A. Rice.

The speaker of the evening was Thomas Kaufman, in charge of the Speaker's Bureau for the Allis-Chalmers Co., who delivered an interesting address titled, *This Is Our America.* His talk painted a vivid word picture of the Communist menace and was received with a great deal of enthusiasm. Attendance 63.

• *NORTHEASTERN OKLAHOMA*—October 9, 1951. The presiding officer, R. W. Winget, called the meeting to order at Wynn's Restaurant following an excellent steak dinner. Prior to the reading and approval of minutes, the following guests were introduced: James McKinney, Earl Offut, Russ Sigler, Leon Briggs, Truman Allen, Bruce Peterson, Robert Arbuckle, Jr., and Bud Shaddock.

The speaker of the evening was L. L. Arbuckle, Bell & Gossett Co., Morton Grove, Ill., who gave a talk on the subject, *Heat Transfer Equipment Used in Refrigeration Work.* Proof of the interest created by the address was the lively question and answer period which followed. Attendance 23. Attendance ratio 0.57.

• *NORTHEASTERN OKLAHOMA*—September 11, 1951. The meeting was called to order by Pres. R. F. Shoemaker in Wynn's Restaurant, and the minutes of the previous meeting were read and approved. Following a brief business session, the meeting was turned over to the two guest speakers of the evening, Frank Clements, manager, Sewell Paint and Varnish Co., Tulsa, and V. W. Miles, Oklahoma Natural Gas Co., Tulsa, and a member of the Chapter. Mr. Clements gave an interesting address on the subject, *Paint Need Not Peel,* and Mr. Miles provided an equally engaging presentation, titled, *The Part Gas Heating Plays in Causing Paint to Peel.* In his talk, Mr. Miles brought out the point that proper venting of the products of combustion of natural gas is one of the secrets of preventing condensation problems. Attendance 24. Attendance ratio 0.54.

• *NORTHERN OHIO*—October 8, 1951. The meeting was called to order by Pres. John Richmond in

the Warner Auditorium of the Cleveland Engineering Building, Cleveland. Prior to the regular meeting, William Cowan, of the Council of World Affairs, provided an interesting review on the subject, *What We Are Doing in Korea.*

Following the reading and approval of minutes, reports were made by J. R. Venning, meetings chairman, who urged all members to get their dinner reservations in by noon of the Friday preceding the meeting; and by Cyril Tasker, director of research, ASHVE Research Laboratory, who announced that the official inauguration of the Society's new Environment Laboratory was scheduled for November 1 and 2. Mr. Tasker then introduced Dr. Roux, principal research officer of the *National Building Research Institute*, South Africa, who was in the United States at the time to study the human calorimeter now under construction at the Research Laboratory for the Office of Naval Research.

The speaker of the evening was H. T. Kucera, president of Automatic Devices Co., Inc., Western Springs, Ill., and a member of Group D of the Society's Technical Advisory Committee on Panel Heating and Cooling. He provided an interesting address on the subject, Control of Building Heating from Outdoors. Attendance 65. Attendance ratio 0.32.

• *OKLAHOMA*—October 8, 1951. Pres. J. H. Carnahan called the meeting to order in Beverly's Drive-In and introduced R. W. Winget of the Northeastern Oklahoma Chapter and five students from the Student Branch at Oklahoma A & M College. He then read a communique from Society Headquarters which extended a cordial invitation to all Chapter members to visit the Research Laboratory in Cleveland on November 2 for the purpose of viewing the newly completed Environment Laboratory. President Carnahan next urged all members to attend the Society's 58th Annual Meeting in St. Louis, January 28 to 30, and suggested that all members interested in securing reservations on a private car should contact Vice Pres. S. J. White.

The speaker of the evening was L. L. Arbuckle, manager, Refrigerating Division, Bell & Gossett Co., Morton Grove, Ill., who provided an interesting talk on *Heat Exchanger Design and Construction for Air Conditioning Systems.* Attendance 60. Attendance ratio 0.56.

• *ONTARIO*—October 2, 1951. Pres. William Philip called the meeting to order in the Royal York Hotel, and, following the reading and approval of minutes of the previous meeting, three new members were introduced. They are: W. C. Boddington, H. L. Coleman, and J. H. Gregory. The only report given during a short business meeting was by J. H. Fox, who disclosed that the Ontario Chapter's proposed code for heating of small residences had been submitted to the Council, but that due to certain legal aspects, it had to be rejected.

The speaker of the evening was Lauren E. Seeley, president of the Society and dean, College of Technology, University of New Hampshire, Durham, N. H., who gave his highly interesting address, *Engineering with a Human Touch.* Attendance 101. Attendance ratio 0.45.

• *OREGON*—September 6, 1951. The meeting was called to order by Pres. H. W. McKenzie in the Heathman Hotel and, following the introduction of guests, minutes of the previous meeting were read and approved.

R. P. Lankow, secretary, then introduced seven new Chapter members, and Dick Blankenship, membership chairman, followed by reporting that several applications are pending and others are in the processing stage. Reports also were made by K. R. Murhard, social committee chairman, and W. R. Pindell, the treasurer.

President McKenzie then called on R. C. Chewning to present a pair of cast bronze book ends to B. W. Farnes in recognition of Mr. Farnes' outstanding work as chairman of the Committee on Arrangements for the Semi-Annual Meeting last July.

After a short recess, the meeting was turned over to the speaker of the evening, J. A. Tudor, consulting and application engineer, Westinghouse Electric Manufacturing Co., who spoke on the subject, *Motors and Maintenance in the Air Conditioning Field.* His presentation was interesting and well received. Attendance 65. Attendance ratio 0.40.

• *PHILADELPHIA*—October 11, 1951. The meeting was called to order by Pres. E. K. Wagner in the Engineers Club, and reports by the secretary and the treasurer were read and approved.

Since there was no other Chapter business, the meeting was immediately turned over to the guest speaker of the evening, C. F. Neergaard, Neergaard, Agnew & Craig, New York consulting firm in the field of hospital planning, organization, and management. In his interesting address, titled, *Some Features of the Mechanical Hospital Plant*, which expressed the viewpoint of the operator, Mr. Neergaard advanced the opinion that heating, ventilating and air conditioning systems too often are oversized and contain equipment that is not essential. From his observations, he has concluded that much elaborate equipment intended to effect exact conditions is not being used, due to a lack of operational knowledge, or to save fuel. Attendance 70. Attendance ratio 0.31.

• *PITTSBURGH*—October 15, 1951. Pres. W. D. Simpson called the meeting to order in the Webster Hall Hotel and the minutes of the previous meeting were read and approved. Reports were given by B. B. Reilly, program chairman, who announced that architect T. B. Pratt would be the speaker at the next meeting; and by O. L. Williams, who reported that the roster was being rushed to completion.

The speaker of the evening was R. J. S. Pigott, director of the Engineering Division, Gulf Oil Corp., who addressed the group on the subject, *Petroleum Power and Its Destiny*. In his talk, which was extremely interesting and well received, Mr. Pigott warned that our oil reserves are diminishing and that we must begin to give serious thought to more intelligent use of this valuable resource. He then went on to cite several methods by which substantial amounts of oil could be conserved, among them an improvement in efficiency of motors and diesel engines. He further stated that important savings could be effected in the heating field by utilizing sun, wind, tidal and hydro-electric power as sources of energy. Attendance 91. Attendance ratio 0.40.

• *ST. LOUIS*—October 9, 1951. C. H. Burnap called the meeting to order and the reading and approval of the minutes and the treasurer's report followed. Mr. Burnap, acting for the meetings committee, suggested another Ladies Night for the December meeting. Two types of programs were proposed, one, a dinner-dance party, and the other, a *get-acquainted* hour which would be followed by a speaker on a non-technical subject. The majority indicated that the latter program would be preferred. Mr. Evans followed by reporting on the progress of the Committee on Arrangements for the Annual Meeting, to be held in St. Louis, January 28-30.

Mr. Burnap then introduced A. V. Hutchinson, executive secretary of the Society, who spoke briefly on the Annual Meeting. He stressed the importance of the technical sessions and stated that two papers were being presented by members of the St. Louis Chapter. Mr. Hutchinson disclosed further that advance reservations indicated a good attendance could be expected.

The speaker of the evening was A. G. Hillen, Carrier Corp., who spoke on the subject, *Air Conditioning Multi-Story, Multi-Room Buildings*. Many important points about the design of such systems were brought out by the presentation. Attendance 49.

• *SHREVEPORT*—October 17, 1951. The Chapter held a highly successful joint meeting with the Student Branch of the Louisiana Polytechnic Institute in Bogard Hall at the Institute. Pres. S. W. Beaty presided over the meeting, and, following the reading and approval of the minutes, appointed a nominating committee comprised of these members: B. E. Segall, W. E. FitzGerald, L. C. Haas, A. H. Otto, and R. L. Patton.

The meeting was then turned over to R. M. Hood, program chairman, who introduced the guest speaker of the evening, H. W. Broadwell, sales manager, Southwestern Division, York Corp., Houston, Tex. Mr. Broadwell discussed the air conditioning industry as he has seen it develop during his 29 years with the York Corp. The address was extremely interesting and well received.

• *SHREVEPORT*—September 20, 1951. Pres. S. W. Beaty called the meeting to order in the Cado Hotel, and the minutes of the previous meeting were read and approved.

The meeting was immediately turned over to R. L. Patton, member of the program committee, who introduced the guest speaker of the evening, F. L. McFadden, Jr., engineer, Zumwalt & Vinther, consulting mechanical engineering firm, Dallas, Tex. Mr. McFadden, who was chief design engineer for the heat pumping installation of the Lower Colorado River Authority office building, used that project as a basis for his address. He pointed out that the system has been in operation for more than a year, and, since original balancing and adjusting was completed, it has required nothing except motor oiling and filter cleaning. Attendance 38.

• *SOUTH TEXAS*—October 19, 1951. Pres. R. J. Salinger called the meeting to order in the Alabama Cafeteria, and the introduction of guests and several past presidents followed.

After the reading and approval of minutes of the previous meeting, reports were made by C. L. Fleming, program chairman, who announced the program for the November meeting; J. C. Lewis, who reported for the Engineers Council; and President Salinger, who brought the group up to date on the status of the new city code.

The speaker of the evening was D. S. Cooper, owner Dale S. Cooper & Assocs., Houston, Tex., who made an excellent presentation on the subject, *Duct Design, Air Distribution, and Sound Control*. Attendance 79. Attendance ratio 0.28.

• *SOUTHWEST TEXAS*—September 18, 1951. The meeting was called to order by Pres. I. W. Wilkie in the Austin Hotel, Austin, and the reading and approval of minutes of the previous meeting followed. In an abbreviated business session, plans were discussed for the all-day conference which was scheduled for late in October. All speakers were confirmed and a great deal of enthusiasm was shown for the event.

As a change of pace, a round table discussion was the feature of the evening. The subject was *Cooling and Heating as Applied to Texas Construction*, with M. K. Witt, Jr., acting as moderator. Discussed were: (1) design conditions — summer and winter; (2) distribution of tempered air; (3) heating disposal for cooling apparatus (air cooled or water cooled); (4) utility services — costs and availability; and (5) controls.

As an extra feature, Vice Pres. W. E. Long provided an interesting report on Research House No. 4 which is located in Austin, and contains a radiant heat test job. This house is built on an uninsulated concrete slab and tests conducted by Professor Long reveal that 50 percent of the heat is being lost. Professor Long further stated that electronic controls are used and have proved extremely satisfactory, with no over-

heating being detected thus far. In conclusion, he produced a cost comparison which would indicate that the application costs about 20 percent more than the conventional forced job. Attendance 35. Attendance ratio 0.35.

• *WESTERN MICHIGAN*—October 8, 1951. W. C. DeRoo was named president, H. R. Limbacher, vice president, and P. D. Winchester, secretary, in a special election necessitated by the resignation of Pres. V. H. Hill, who has accepted a new position in the east. In addition, L. A. Tilford was elected to fill a board of governors post which was left vacant due to a misbelief at the election last May that only two such positions had to be filled.

Following the election and a short business session, Mr. Limbacher introduced the guest speaker of the evening, E. R. Queer, professor of engineering research, Engineering Experiment Station, The Pennsylvania State College, State College, Pa. Professor Queer gave an interesting talk on his experiences as a member of the U. S. Navy engaged in research into dehumidification problems for *Operation Mothball*, the famous project of several years ago which inactivated countless Naval vessels in such a way that they could be returned to service on short notice. Attendance 81.

• *WESTERN NEW YORK*—October 8, 1951. The meeting was called to order by Pres. T. F. Killeen, and the minutes of the previous meeting were read and approved. Business covered in a short session included reports by Q. P. Thompson, representative to the Technical Societies Council, who dealt with the status of the proposed new building and industry conference scheduled for April 1952, and by J. M. Quackenbush, first vice president, who touched upon various aspects of the November meeting.

The speaker of the evening was Stuart Kibbe, training supervisor of the Iron Fireman Co. He gave an interesting presentation on the use of several types of fuel oil and the type of equipment required to utilize them properly. A lively question and answer period followed the address. Attendance 24.

• *WISCONSIN*—October 15, 1951. Pres. H. F. Brinen called the meeting to order in the Engineering Society Building, Milwaukee, and welcomed the many architects, heating contractors, plant engineers, and other engineers who were on hand as guests of the Chapter.

In the only business conducted prior to the address of the evening, I. J. Rossiter, membership chairman, introduced the following new members of the Chapter: H. C. Washecheck, D. W. Retzinger, K. W. Radmer, H. J. Lonn, R. A. Panlener, R. W. Herman, and H. W. Snyder.

The speaker was Henry Wright, architectural consultant, New York City, who spoke on the subject, *Classroom Heating*.

Mr. Wright pointed out that, since classrooms were in use only about 20 percent of the time, heating equipment was required which would quickly and economically raise temperatures to the desired level. While radiant heating affords comfort advantages, particularly for kindergarten and lower classes, the response of these systems generally is so slow that it is necessary to keep such areas at a higher temperature level during unoccupied periods. This results in greater fuel use and more costly operation.

Mr. Wright then went on to say that, because classrooms usually are high occupancy areas, the heating and ventilating equipment must do a cooling job rather than a heating job during a large percentage of the occupied period. This condition of overheating is further aggravated by solar heat gain, due to the great amount of glass used in typical classroom construction, particularly if the classroom orientation includes south and west exposures.

As a result of numerous investigations, Mr. Wright said, it has been determined that many classrooms require heating for only two or three hours a day, and that the heating and ventilating equipment must do a cooling job the remainder of the day, if overheating is to be prevented.

Due to these inherent characteristics of classroom heating, Mr. Wright continued, automatic control of each room is imperative, and the controls, furthermore, must be quickly responsive to load changes. This aspect would include the necessary provision for the maintenance of satisfactory air temperatures during the cooling cycle, to prevent uncomfortable environmental conditions.

Mr. Wright also presented some interesting figures on optimum temperatures for different types of class activity. These indicated that, while 68 F temperatures produced the most favorable environment for typing classes, temperatures as high as 76 F were required for student activities requiring mental application alone. The effects on comfort where large windows were used were discussed in terms of the effect on metabolism and environmental conditions. Also discussed was the possibility of using reflective type shades at night, to substantially reduce heat loss.

In conclusion, Mr. Wright said that most modern educators are vitally interested in anything that will expedite student achievement and suggested that more research be done on classroom heating and ventilating. Attendance 96. Attendance ratio 0.32.

• *OKLAHOMA A & M COLLEGE*—October 26, 1951. Pres. O. A. Brynie called the meeting to order in Room 302 of the Engineering Building on the campus and immediately turned the session over to the guest speaker, W. J. Collins, of the consulting firm, Collins and Gould, Oklahoma City, who gave an interesting talk on the duties of the consulting engineer.

In a short business meeting that

followed, President Brynie revealed that the next field trip was scheduled for November 30. He suggested that, since there was a relatively small number of student members, the group should go to the speaker instead of the speaker coming to them.

President Brynie also disclosed that H. S. Shafer of the Oklahoma City Chapter had volunteered his services to arrange monthly inspection trips to replace regular meetings. He further suggested that the group visit an installation for one meeting and then plan to discuss that project at the next regularly scheduled gathering. Attendance 9. Attendance ratio 0.58.

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society, or mailed to all members. When the replies are received from references, the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month, there have been 82 applications for membership, including 13 student applications and 2 reinstatements; in addition 7 advancements have been received. The names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by December 31, 1951, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

AMBROSE, R. S., Field Engr., Chrysler Airtemp Sales Corp., Kansas City, Kans. REFERENCES: P. J. Cummings*, J. S. Dukelow, W. I. Snodgrass, Jr., D. S. Truog.

APPLING, E. B., Engr., Reg F. Taylor, Cons. Eng., Houston, Tex. REFERENCES: Lacy Key, Jr., R. K. Ritner, R. J. Salinger, R. F. Taylor.

ARENDTS, E. M., Engr., Campbell Heating Co., Des Moines, Ia. REFERENCES: E. M. Bartels, E. H. Borg, Bowen Campbell, C. P. North.

BINDER, W. J., Mgr., Engineering Service Dept., A. M. Byers Co., Pittsburgh, Pa. REFERENCES: C. L. Benn, J. B. Fullman, H. K. King, R. T. McCalmon.

BRENNER, H. H., Supt. & Engr., Thomas E. Hoye Heating Co., Milwaukee, Wis. REFERENCES: W. T. Holland, L. C. Plaehn, H. W. Schreiber, J. H. Volk.

BROOKS, W. C., Jr., Sales Repr., Rheem Manufacturing Co., San Francisco, Calif. REFERENCES: E. A. Fernsten, J. M. Marr, J. D. Mitchell, S. W. Terry.

BUONACCORSI, A. L., Co-Partner, Garthorne, Buonaccorsi & Murray, San Francisco, Calif. REFERENCES: J. O. Martin, H. R. Scandrett, T. J. White, D. L. Williams.

BURK, S. Z., Chief, Mech. Section, Dept. of Army, Corps of Engineers, Norfolk, Va. REFERENCES: J. F. Boyenton, W. A. Cox, Jr., R. C. Thomas, Laurence Trant.

COHAN, H. A., Jr., Air Conditioning Engr., Sperry Gyroscope Co., Great Neck, N.Y. REFERENCES: H. J. Campbell*, C. W. Hartmann, Jr., A. F. Hinrichsen, J. L. Page.

COOBS, M. E., Sales Engr., Johnson Service Co., Chicago, Ill. REFERENCES: N. E. Bueter, J. E. McClellan, F. W. Riederer, O. G. Ward.

CRICHTON, A. L., Mech. Designer, Walter Kidde Constructors, Inc., New York, N. Y. REFERENCES: H. W. Austin*, Ernst Graber, A. W. Knecht, A. B. Waterbury*.

DENNELL, A. R., Partner, R. K. Dennell & Son, Omaha, Nebr. REFERENCES: G. W. Colburn, C. A. Failor, K. E. Martin, B. G. Peterson.

DESHAW, F. C., Engr., Boeing Airplane Co., Seattle, Wash. REFERENCES: J. A. MacDonald, K. H. Norby, W. B. Pride, E. B. Tupper.

D'EUSTACHIO, D., Chief Physicist, Pittsburgh Corning Corp., Port Allegany, Pa. REFERENCES: G. V. Parmelee, E. R. Queer, F. B. Rowley, Cyril Tasker.

DIGIACOMO, W. A., Designer, Voorhees, Foley, Walker & Smith, Inc., New York, N. Y. REFERENCES: Stanley Dicker, Norman Goldberg, Gershon Meckler, L. H. Monroe.

DODSON, H. L., Chief Engr., Finney, Wolcott & Assoc., Baltimore, Md. REFERENCES: Edwin Bock, E. L. Crosby, W. C. Feige, Jr., E. H. Taze.

DUVAL, J. E., Jr., Sales Engr., Johnson Service Co., Detroit, Mich. REFERENCES: I. L. Burns*, W. F. Chase*, W. R. Farrington, J. J. Uicker.

ESCH, F. M., Pres., Esch Condit Inc., Houston, Tex. REFERENCES: R. W. Cumming, A. Hedjuck*, W. B. Watterson, W. J. Way, II.

FINCH, W. C., Sales Engr., Ernest Engineering Inc., New Orleans, La. REFERENCES: C. V. Bankston, E. A. Burguieres, Jr., L. V. Busenener, J. D. Maddox.

FORD, J. W., Engrg Assoc., Robert S. Curl & Associates, Columbus, Ohio. REFERENCES: R. M. Keatts, W. A. Schoonover, F. C. Seabright, J. D. Siemmons.

FRAZIER, J. W., Gen. Sales Mgr., Trion Inc., McKees Rocks, Pa. REFERENCES: G. F. Landgraf, B. B. Reilly, E. H. Riesmeyer, Jr., O. L. Williams.

FRITZ, W. J., Regional Mgr., Iron Fireman Corp., Seattle, Wash. REFERENCES: W. E. Gleeson, J. W. James, E. N. McDonnell, N. W. Swanson.

FUNATAKE, TAI, Design Draftsman, W. Bruce Morrison, Cons. Engr., Portland, Ore. REFERENCES: Dick Blankenship, J. S. Bowen, Jr., R. F. Marquess, W. B. Morrison.

GILL, J. E., Chief Engr., Buffalo Forge Co., Buffalo, N. Y. REFERENCES: C. A. Booth, W. R. Heath, M. S. Jackson, R. L. Pleuthner.

GILLAN, M. S., Student Engr., Carrier Corp., Syracuse, N. Y. REFERENCES: J. H. Carpenter, J. N. Clemmer*, R. L. Jones*, Americo Silvera.

GORRELL, L. R., Owner, Colonial Equipment Co., Raleigh, N. C. REFERENCES: C. G. Hartsfield, R. K. Hunter, J. M. Pleasants, G. B. Rottman.

GRANT, H. D., Sales Engr., F. J. Evans Engineering Co., Houston, Tex. REFERENCES: A. F. Barnes, G. D. Hines, M. E. Linn, D. M. Mills.

HARDY, F. K., Vice Pres., Capital Refrigeration Co., Inc., Montgomery, Ala. REFERENCES: Marvin Crout, L. J. Drum, Jr., E. O. Hull, E. B. Miller.

HIRTZ, J. F., Treas. & Chief Engr., Syncromatic Corp., Watertown, Wis. REFERENCES: A. B. Algren, Paul Lickliter*, J. S. Thompson*, H. E. Winkler*.

HOUGH, J. K., Sales Engr., J. K. Hough Co., Cincinnati, Ohio. REFERENCES: R. A. Albrecht, Jr., C. A. Eades*, David Jacobson*, E. J. Richard.

*Non-Member

JONES, K. W., Htg. Vtg. Designer, Air Ministry, London, England. REFERENCES: C. A. Atwood*, J. G. Griffith*, C. V. Jones*, A. G. Roberts.

LACY, F. P., Engr. in Training, Lacy, Atherton & Davis, Wilkes-Barre, Pa. REFERENCES: T. H. Atherton*, J. W. Davis*, D. B. McDonald, R. E. Roushey*.

LAMARSH, J. F., Sales Engr., George H. Cole Supply Co., Troy, N. Y. REFERENCES: L. F. Cole, Jr., F. R. Foote, H. F. Kruger, K. T. Sprague.

LINDGREN, D. R., Owner, Lindgren's Air Conditioning, Winnebago, Minn. REFERENCES: R. H. Lee, R. H. Lindgren, W. A. Swenberg, W. T. Swingle.

MARTIN, E. H., Jr., Mgr., Building Insulation Sales, Pittsburgh Corning Corp., Pittsburgh, Pa. REFERENCES: R. H. Heilman, E. R. Queer, Ray Thomas*, W. H. Zane*.

MARTINSEN, R. O., Pres., Electric Heating, Inc., Buckingham, Pa. REFERENCES: H. J. Harris, W. S. Scott, A. D. Spillman*, W. K. Stauffer*.

MASON, R. L., Asst. Prof. of Mech. Engrg., Texas Technological College, Lubbock, Tex. REFERENCES: W. R. Anthony, Linn Helander, R. B. Ince, D. C. Pfeiffer.

MAYNARD, W. G., Product Application Engr., Herman Nelson Div., American Air Filter Co., Inc., Baltimore, Md. REFERENCES: H. A. Akers, G. M. Heslop, R. L. Hughes, Jr., G. B. Priester.

MEYERS, R. E., Mfr's. Repr., Bell & Gossett, New Orleans, La. REFERENCES: S. W. Beaty, L. C. Haas, C. M. Hadra, R. M. Hood.

MILLER, V. L., Asst. to Tech. Director, Pittsburgh Corning Corp., Port Allegany, Pa. REFERENCES: A. H. Baker*, R. A. Miller, E. R. Queer, Vic Sanders.

NOORBAKHSH, A. H., Engr., New York, N.Y. REFERENCES: A. B. Epple, H. E. Keeler, Axel Marin, L. E. Wagner*.

ORSINGER, W. A., Mech. Engr., Alaska District Engineers, Seattle, Wash. REFERENCES: John Dingwall*, R. D. Hoss, S. R. Ludlow*, Bruce Maxon*.

PANO, P. V., Application Engr., Westinghouse Electric Corp., Sturtevant Div., Chicago, Ill. REFERENCES: D. W. Davis, Jr., H. M. Fisher*, E. N. Foss*, G. F. Spooner.

PAYNE, G. N., Jr., Designer, Mechanical Engineers, Inc., Charlotte, N. C. REFERENCES: L. B. Hoffman, E. C. Jones, E. D. Streng, W. P. Wells.

POETZEL, G. J., Pres., Cardes Supply Co., Milwaukee, Wis. REFERENCES: C. H. Amundson, W. F. Boden, F. E. Graper, F. H. Otto.

POLLAND, STANLEY, Sec'y.-Treas., Hess, Greiner & Polland, Los Angeles, Calif. REFERENCES: L. B. Davenport, J. S. Earhart, M. C. Greiner, A. J. Hess.

*Non-Member

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OBITUARIES

JOHN G. BLANCHARD
Dearborn, Mich.

John G. Blanchard, a sales engineer with the American Blower Corp., and a member of the Society, passed away recently in Dearborn, Mich. He was 30 years old and had been ailing for several months.

Born in Detroit, Mich., on November 9, 1921, Mr. Blanchard was graduated from Michigan State College in 1947 with a B.S. degree in mechanical engineering. He began his business career that same year when he joined American Blower in Cincinnati, where he was located until his transfer to Dearborn last spring. Mr. Blanchard joined the Society in 1950 and was a member of the Cincinnati Chapter.

The Officers and Council extend their sincere sympathy to Mr. Blanchard's widow.

WALTER L. MAYNE
Cincinnati, Ohio

Walter L. Mayne, a member of the Society, and owner of the firm, Plumbing and Heating Specialities, Cincinnati, Ohio, died on October 14 in Cincinnati.

Born in Lockport, N. Y., on April 6, 1886, and educated in schools in that area, Mr. Mayne spent his entire career in the heating field in management, sales engineering, and sales capacities. Firms with which he was connected included the United States Radiator Corp., as Cincinnati branch manager; Marsh Valve Co., Dunkirk, N. Y., as vice president and sales manager; and Tanner Manufacturing Co., Erie, Pa., as production-sales engineer. He became owner of Plumbing and Heating Specialities in 1948.

Mr. Mayne was elected to membership in the Society in 1937. He also was a member of the Cincinnati Chapter.

The Officers and Council extend their sincere sympathy to his family.

HOWARD W. POUND
Louisville, Ky.

Howard W. Pound, a member of the Society and a vice president of the American Air Filter Co., Inc., died on October 10 in Louisville, Ky.

Mr. Pound was born in Leesburg, Ind., on October 26, 1896, and was graduated from Purdue University in 1921 with a B.S. degree in mechanical engineering. A well known figure in the air filter field, he was sales manager of the Independent Air Filter Co., Chicago, Ill., for many years before joining American Air Filter. He became connected with American Air Filter in 1940 as sales manager of the firm's electro-matic division and a few years later was appointed manager of the air filter sales division. In 1947, he was named to his post as vice president.

H. W. Pound

Mr. Pound was extremely interested in the activities of the Society, having been responsible for many new memberships during the past ten years, and was a familiar figure at many Society functions. He served in a number of Society positions, among them being the Public Relations Committee in both 1950 and 1951.

Mr. Pound was a 32 degree Mason and a member of the Shrine Kosair Temple. During World War I, he served as an aviator in the United States Navy.

The Officers and Council extend their sincere sympathy to Mrs. Pound.

HAYDN MYER
Birmingham, Ala.

Haydn Myer, a member of the Society, and president of the firm, Haydn Myer Co., Inc., manufacturers' representatives, died on October 14 in Birmingham, Ala. He was 56.

Born in Lincoln, Nebr., on December 3, 1895, Mr. Myer entered the manufacturers' representative field in 1924 as an individual, continuing under that arrangement until 1936, when he formed the company which bears his name.

He is survived by his widow, Mrs. Julia Carney Myer, three daughters, Miss Martha Ann Myer, of Ithaca, N.Y., Mrs. Robert W. McKenzie, and Mrs. Frank R. Trechsel, Jr., and two grandchildren, Miss Martha Terri McKenzie and Frank R. Trechsel, III, all of Birmingham, Ala., to whom the Officers and Council extend their sincere sympathy.

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● **CINCINNATI:** Organized 1932. Headquarters, Cincinnati, Ohio. Meets, First Tuesday. PRESIDENT, J. J. Bechtol, P.O. Box 1667, Cincinnati 1. SECRETARY, R. C. Beineke, 626 Broadway, Cincinnati 2.

● **CONNECTICUT:** Organized 1940. Headquarters, New Haven, Conn. Meets, Third Thursday. PRESIDENT, A. J. Lawless, 110 Whitney Ave., New Haven. SECRETARY, R. W. Sidbury, 256 Grand St., Waterbury 91.

● **DELTA:** Organized 1939. Headquarters, New Orleans, La. Meets, Second Tuesday. PRESIDENT, Theodore Offner, 1000 S. Peters St., New Orleans. SECRETARY, H. L. Salaun, 317 Baronne St., New Orleans.

● **EMPIRE STATE CAPITAL:** Organized 1951. Headquarters, Albany, N. Y. PRESIDENT, D. A. Carofano, 1821 Highland Ave., Troy. SECRETARY, G. G. Davis, 323 State St., Schenectady.

● **GOLDEN GATE:** Organized 1937. Headquarters, San Francisco, Calif. Meets, First Thursday. PRESIDENT, T. J. Janes, University of California, Dept. of Grounds & Bldgs., Berkeley 4. SECRETARY, J. E. Murray, 1095 Market St., San Francisco 3.

● **ILLINOIS:** Organized 1906. Headquarters, Chicago, Ill. Meets, Second Monday. PRESIDENT, George W. Bornquist, 605 W. Washington Blvd., Chicago 6. SECRETARY, G. V. Zintel, 1217 W. Washington Blvd., Chicago 7.

● **INDIANA:** Organized 1943. Headquarters, Indianapolis Ind. Meets, Fourth Friday. PRESIDENT, P. C. Barton, 912 K. of P. Bldg., Indianapolis. SECRETARY, R. C. Blackman, 5505 N. Illinois St., Indianapolis 8.

● **INLAND EMPIRE:** Organized 1950. Headquarters, Spokane, Wash. Meets, First Friday after First Tuesday. PRESIDENT, L. E. Marque, 3803 N. Atlantic, Spokane. SECRETARY, R. J. Harris, 316 N. Division St., Spokane 8.

● **IOWA:** Organized 1940. Headquarters, Des Moines, Ia. Meets, Second Tuesday. PRESIDENT, C. H. McGuiness, 712 Park St., Des Moines. SECRETARY, J. F. Sandfort, M. E. Dept., Iowa State College, Ames.

● **KANSAS:** Organized 1951. Headquarters, Wichita, Kan. PRESIDENT, R. F. Bauer, 434 N. Rock Island, Wichita. SECRETARY, E. G. Fahnestock, P.O. Box 2581, Hillside Station, Wichita.

● **KANSAS CITY:** Organized 1917. Headquarters, Kansas City, Mo. Meets, First Monday. PRESIDENT, C. W. Schumacher, 1920-22 Grand Ave., Kansas City, Mo. SECRETARY, G. H. Stoffer, 200 Land Bk. Bldg., Kansas City 6, Mo.

● **MANITOBA:** Organized 1935. Headquarters, Winnipeg, Man., Canada. Meets, Third Thursday. PRESIDENT, J. F. Bertram, 550 Notre Dame Ave., Winnipeg. SECRETARY, A. K. Piercy, 222 Osborne St., N., Winnipeg.

● **MASSACHUSETTS:** Organized 1912. Headquarters, Boston, Mass. Meets, Third Tuesday. PRESIDENT, John Bonner, 92 Broadway, Cambridge 42. SECRETARY, L. R. Geissenhainer, 89 Broad St., Boston 10.

● **MEMPHIS:** Organized 1944. Headquarters, Memphis, Tenn. Meets, Third Monday. PRESIDENT, R. E. Larkin, 515 W. Clover Dr., Memphis. SECRETARY, A. T. Bevil, 212 Robinson Bldg., 160 Union, Memphis 3.

● **MIAMI VALLEY:** Organized 1950. Headquarters, Dayton, Ohio. Meets, First Wednesday. PRESIDENT, C. D. Weaver, 1136 U.B. Bldg., Dayton 2. SECRETARY, R. W. Kimmel, 947 Westminster Pl., Dayton 9.

● **MICHIGAN:** Organized 1916. Headquarters, Detroit, Mich. Meets, First Monday after 10th of month. PRESIDENT, G. W. Akers, Box 238, R.F.D. 2, Rochester, Mich. SECRETARY, R. H. Oberschulte, 316 McKerchey Bldg., Detroit 1.

● **MINNESOTA:** Organized 1918. Headquarters, Minneapolis, Minn. Meets, First Monday. PRESIDENT, E. F. Snyder, Jr., 4524 Zenith Ave. N, Minneapolis 22. SECRETARY, J. A. Holbrook, 65 North 17th St., Minneapolis 3.

● **MONTREAL:** Organized 1936. Headquarters, Montreal, Que., Canada. Meets, Third Monday. PRESIDENT, J. G. Cbenevert, 1440 St. Catherine St. W., Montreal. SECRETARY, B. J. Horsburgh, 637 Craig W., Rm. 212, Montreal.

● **NEBRASKA:** Organized 1940. Headquarters, Omaha, Neb. Meets, Second Tuesday. PRESIDENT, K. E. Martin, 204 Barker Bldg., Omaha 2. SECRETARY, O. J. Smith, 233 Grain Exchange Bldg., Omaha 2.

● **NEW YORK:** Organized 1911. Headquarters, New York, N. Y. Meets, Third Monday. PRESIDENT, Ernst Graber, 215 Hollywood Ave., Douglaston, L. I. SECRETARY, Carl H. Flink, 62 Worth St., New York 13.

● **NORTH CAROLINA:** Organized 1939. Headquarters, Durham, N. C. Meets, Quarterly. PRESIDENT, R. O. McGary, 2015 Dilworth Rd. E., Charlotte 3. SECRETARY, J. A. Rice, 719 Worthington Ave., Charlotte.

● **NORTH TEXAS:** Organized 1938. Headquarters, Dallas, Tex. Meets, Third Monday. PRESIDENT, R. G. Lyford, 2415 N. Pearl St., Dallas. SECRETARY, P. N. Vinther, 929 Mercantile Securities Bldg., Dallas 1.

● **NORTHEASTERN OKLAHOMA:** Organized 1948. Headquarters, Tulsa, Okla. PRESIDENT, R. F. Shoemaker, 1136 S. Peoria, Tulsa. SECRETARY, F. M. Thomas, 1325 E. 35th Pl., Tulsa 5.

● **NORTHERN OHIO:** Organized 1916. Headquarters, Cleveland, Ohio. Meets, Second Monday. PRESIDENT, John Richmond, 10210 Woodland Ave., Cleveland 4. SECRETARY, R. G. Huebscher, 7218 Euclid Ave., Cleveland 3.

● **OKLAHOMA:** Organized 1935. Headquarters, Oklahoma City, Okla. Meets, Second Monday. PRESIDENT, D. H. Carnahan, 320 Oklahoma Natural Gas Bldg., Oklahoma City 2. SECRETARY, W. J. Collins, Jr., 224 Oklahoma Natural Gas Bldg., Oklahoma City.

● **ONTARIO:** Organized 1922. Headquarters, Toronto, Ont., Canada. Meets, First Monday. PRESIDENT, William Philip, 5 Barbara Crescent, Toronto, Ont. SECRETARY, H. R. Roth, 57 Bloor St., W., Toronto, Ont.

● **OREGON:** Organized 1939. Headquarters, Portland, Ore. Meets, Thursday after First Tuesday. PRESIDENT, H. W. McKenzie, 309 Murray Ave., Beaverton. SECRETARY, R. P. Lankow, 3408 S.E. Hawthorne Blvd., Portland 15.

● **PACIFIC NORTHWEST:** Organized 1928. Headquarters, Seattle, Wash. Meets, Second Tuesday. PRESIDENT, R. M. Stern, 5121 E. 68th, Seattle 5. SECRETARY, H. T. Orebaugh, 1330 Dearborn, Seattle.

● **PHILADELPHIA:** Organized 1916. Headquarters, Philadelphia, Pa. Meets, Second Thursday. PRESIDENT, E. K. Wagner, 2240 N. Broad St., Philadelphia 32. SECRETARY, A. M. Robertson, 1200 Locust St., Philadelphia 7.

● **PITTSBURGH:** Organized 1919. Headquarters, Pittsburgh, Pa. Meets, Third Monday. PRESIDENT, W. D. Simpson, 301 Standard Life Bldg., Pittsburgh 22. SECRETARY, E. H. Riesmeyer, Jr., 231-33 Water St., Pittsburgh 22.

● **ROCKY MOUNTAIN:** Organized 1944. Headquarters, Denver, Colo. Meets, First Wednesday. PRESIDENT, B. H. Spurlock, Jr., Dept. of M. E., University of Colorado, Boulder, Colo. SECRETARY, J. W. Braak, 1230 California St., Denver, Colo.

● **ST. LOUIS:** Organized 1918. Headquarters, St. Louis, Mo. Meets, Second Tuesday. PRESIDENT, L. L. Hamig, 1706 Olive St., St. Louis 3. SECRETARY, J. F. Naylor, Jr., 2335 S. Grand Ave., St. Louis 4.

● **SHREVEPORT:** Organized 1948. Headquarters, Shreveport, La. Meets, Third Thursday. PRESIDENT, S. W. Besty, P.O. Box 1734, Shreveport 4, La. SECRETARY, W. S. Evans, 614 Johnson Bldg., Shreveport.

● **SOUTH TEXAS:** Organized 1938. Headquarters, Houston, Tex. Meets, Third Friday. PRESIDENT, R. J. Salinger, 910 Bankers Mtg. Bldg., Houston 2. SECRETARY, E. G. Floeter, Jr., P.O. Box 6006, Houston 6.

● **SOUTHERN CALIFORNIA:** Organized 1930. Headquarters, Los Angeles, Calif. Meets, Third Wednesday. PRESIDENT, M. C. Greiner, 1599 Club View Dr., Los Angeles 24. SECRETARY, L. B. Davenport, 137 S. Anderson St., Los Angeles 33.

● **SOUTHWEST TEXAS:** Organized 1946. Headquarters, San Antonio, Tex. Meets, Third Tuesday. PRESIDENT, I. W. Wilke, P.O. Box 1154, Austin. SECRETARY, D. E. Locher, Box 949, 224 S. Staples St., Corpus Christi.

● **UTAH:** Organized 1944. Headquarters, Salt Lake City, Utah. Meets, First Wednesday. PRESIDENT, R. H. East, 1086 E. 21st St., Salt Lake City. SECRETARY, D. R. Wilde, 204 Dooly Bldg., Salt Lake City 1.

● **VIRGINIA:** Organized 1946. Headquarters, Norfolk, Va. Meets Third Wednesday. PRESIDENT, J. F. Boyenton, 400 W. 24 St., Norfolk 8. SECRETARY, J. E. Harding, Apt. R-2, St. James Terrace, Newport News.

● **WASHINGTON, D. C.:** Organized 1935. Headquarters, Washington, D. C. Meets, Second Wednesday. PRESIDENT, S. R. Allen, 942 Washington Bldg., Washington 5. SECRETARY, P. H. Loughran, Jr., 4513 49th St., N.W., Washington 16.

● **WESTERN MICHIGAN:** Organized 1931. Headquarters, Grand Rapids, Mich. Meets Second Monday. PRESIDENT, W. C. DeRoo, 500 E. 8th St., Holland, Mich. SECRETARY, P. D. Winchester, 322 Columbia Ave., Holland, Mich.

● **WESTERN NEW YORK:** Organized 1919. Headquarters, Buffalo, N. Y. Meets, Second Monday. PRESIDENT, T. F. Killeen, 374 Delaware Ave., Buffalo 2. SECRETARY, R. E. Lang, 140 Meadow Lane, Kenmore 23.

● **WISCONSIN:** Organized 1922. Headquarters, Milwaukee, Wis. Meets, Third Monday. PRESIDENT, H. F. Brinen, 226 Kenzie Ave., Racine. SECRETARY, L. C. Plaehn, 914 N. Broadway, Milwaukee.

Student Branches

● **COLLEGE OF CITY OF NEW YORK:** Organized 1949. Headquarters, New York, N. Y. PRESIDENT, Seymour Weinberg, 2147 72nd Street, Brooklyn 4. SECRETARY, Benjamin Karp, 524 Berriman St., Brooklyn 8.

● **LOUISIANA POLYTECHNIC INSTITUTE:** Organized 1949. Headquarters, Ruston, La. PRESIDENT, W. G. McMullen, Box 472, Tech Station, Ruston. SECRETARY, R. L. Gorton, Box 184, Tech Station, Ruston.

● **NORTH CAROLINA STATE COLLEGE:** Organized 1948. Headquarters, Raleigh, N. C. PRESIDENT, Sydney Narvey, 5-B Vetville, State College Station, Raleigh. SECRETARY, E. A. Travis, Jr., P.O. Box 5353, Bagwell Dormitory, Raleigh.

● **OKLAHOMA A. & M. COLLEGE:** Organized 1950. Headquarters, Stillwater, Okla. PRESIDENT, O. A. Brvnie, 507 Midi. Vet Village, Stillwater. SECRETARY, D. W. Ray, W361 Bennett Hall, Stillwater.

● **OREGON STATE COLLEGE:** Organized 1949. Headquarters, Corvallis, Ore. Meets, First Wednesday after First Tuesday. PRESIDENT, R. J. Kemper, Jr., 645 N. 4th, Corvallis. SECRETARY, J. M. Templer, 720 Kings Rd., Corvallis.

● **PURDUE UNIVERSITY:** Organized 1948. Headquarters, W. Lafayette, Ind. CHAIRMAN, N. J. Kirch, 922 Highland Ave., Lafayette. SECRETARY, T. L. Burcham, 133 Salisbury St., W. Lafayette.

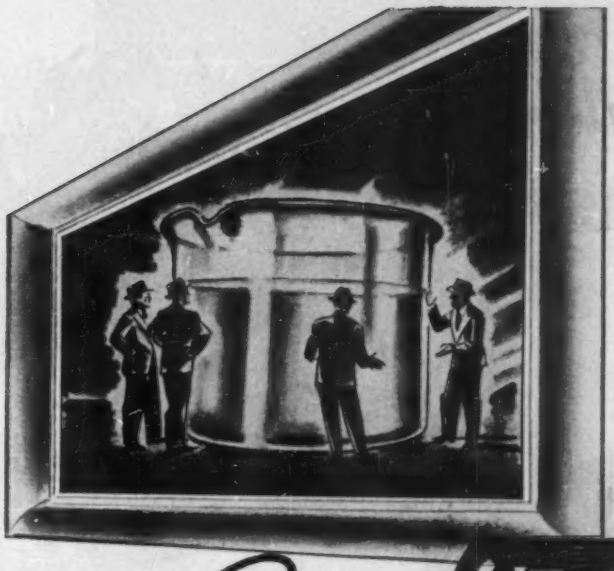
● **TEXAS A. & M. COLLEGE:** Organized 1946. Headquarters, College Station, Tex. Meets, Second and Fourth Tuesday. PRESIDENT, J. O. Kadel, Box 4054, College Station, Tex. SECRETARY, W. C. Haggard, Box 5227, College Station.

● **UNIVERSITY OF DETROIT:** Organized 1949. Headquarters, Detroit, Mich. Meets, First Tuesday. PRESIDENT, G. H. Williams, 18251 Washburn, Detroit 21. SECRETARY, R. H. Drake, 5598 Hurlbut, Detroit 13.

● **UNIVERSITY OF KANSAS:** Organized 1949. Headquarters, Lawrence, Kans. Address mail to Dr. Warren E. Snyder, chairman, Dept. of Mechanical Engineering, University of Kansas.

● **UNIVERSITY OF TEXAS:** Organized 1949. Headquarters, Austin, Tex. Meets, First and Third Tuesday. PRESIDENT, W. A. Cox, 360-D Deep Eddy Apts., Austin. SECRETARY, V. H. Miles, PHP Dorm J, Austin.

● **UNIVERSITY OF TORONTO:** Organized 1951. Headquarters, Toronto, Ont. CHAIRMAN, H. F. Sprage, 35 Harrison Ave., Aurora, Ont. SECRETARY, J. E. G. Blaiklock, 23 Isabella St., Toronto 5, Ont.



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What is the *active* life of your bronze valves? On any given application, *how much fluid* will they efficiently control — in gallons of liquid, cubic feet of air, pounds of steam? How long will they last — *in action?*

Make your own comparison — by calling the maintenance or engineering department of your plant. Whether your valves stand idle much of the time — or are in constant use — you'll find that Lunkenheimer bronze valves handle *more* fluids with less maintenance than any other kind. And there are good reasons why . . .

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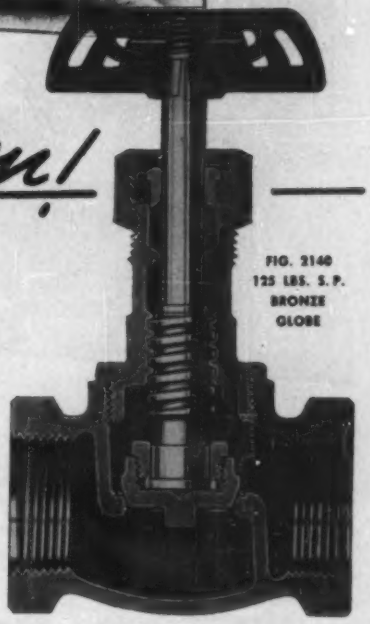

FIG. 2140
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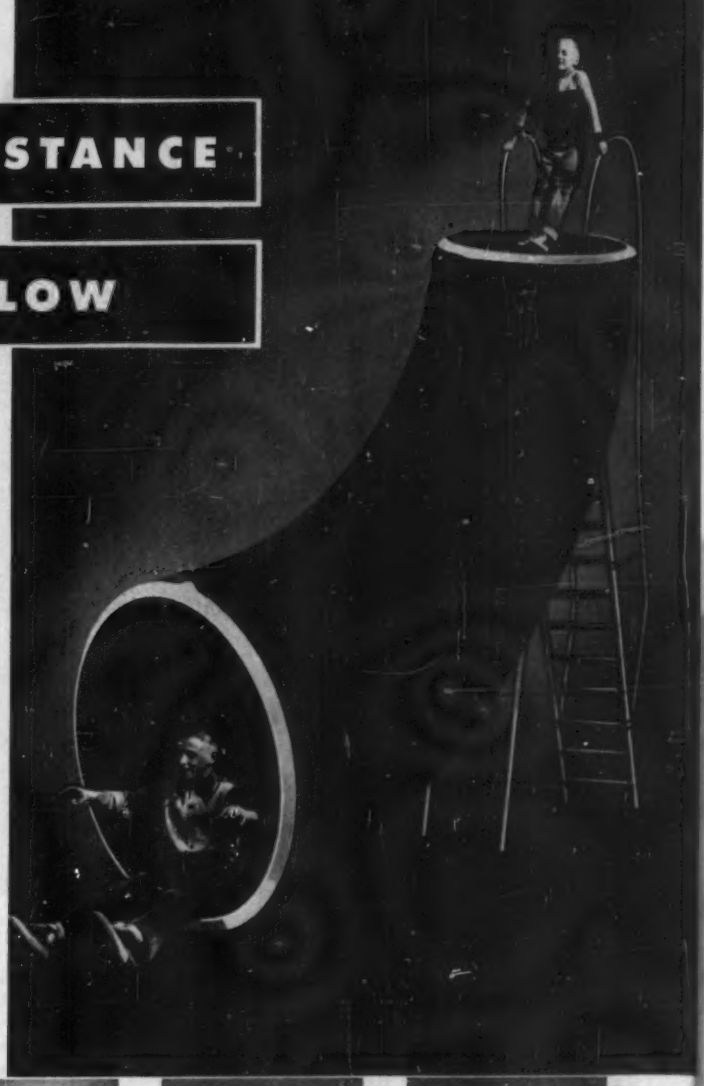

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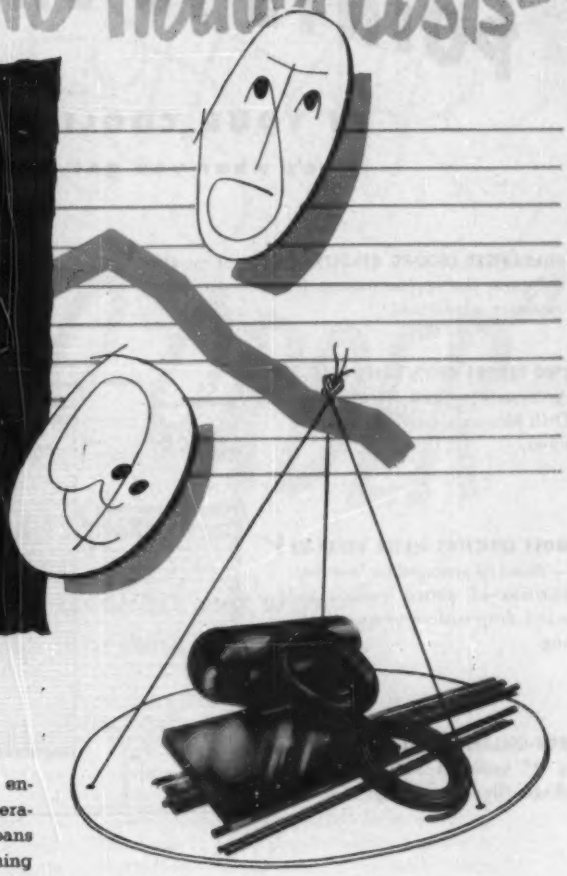

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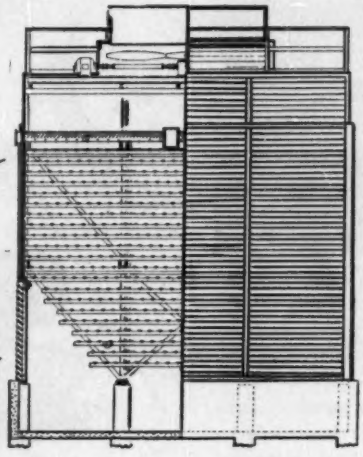

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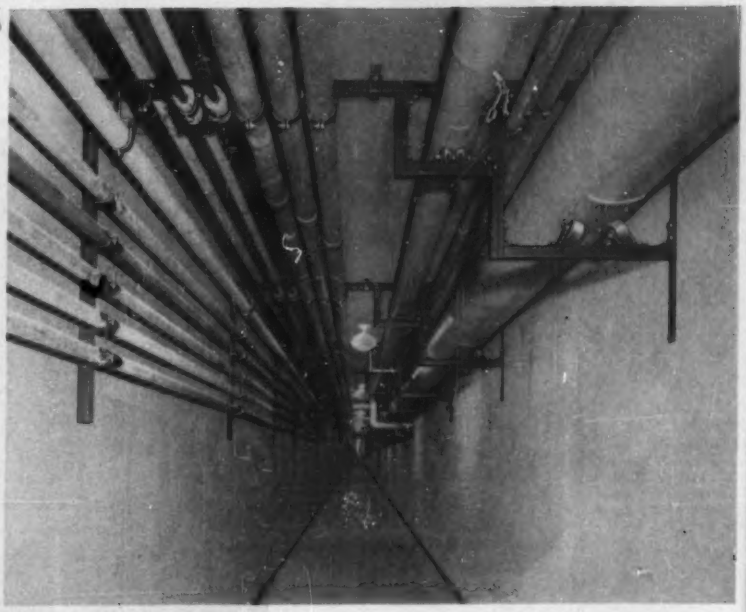

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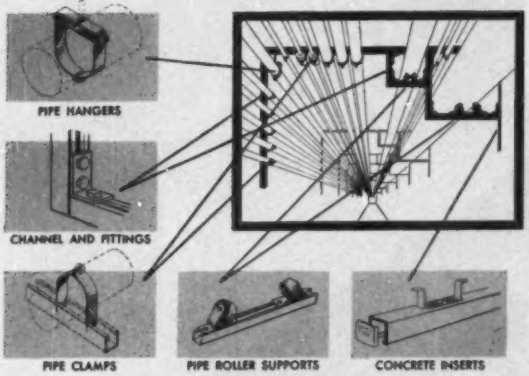
Specifications: Noess & Murphy, Architects—Engineers.
Contractor: Gust K. Newberg Construction Company
Electrical Contractor: Hatfield Electric
Process Piping: Hayes Bros., Inc.



In this large main tunnel installation at Plainfield, Indiana, UNISTRUT channel, concrete inserts, pipe rollers, hangers and clamps support electric, steam, water, air and oil lines—all the services in *one neat package!*

This completely adjustable metal framing system provides a new and more flexible type of mechanical support for every kind of piping, conduit and cable. Assures exact slope or pitch. Permits adjustments, changes or additions to be made at any time. No drilling, no welding, no special tools or equipment. The UNISTRUT method conserves steel, reduces manpower hours, cuts over-all costs.

Representatives and Warehouse Stocks in Principal Cities—Consult Your Telephone Directories

Write for NEW FREE Construction Catalog No. 700

UNISTRUT PRODUCTS COMPANY

1013 W. Washington Blvd., Chicago 7, Ill., Dept. H-12

Please send the items checked below, without obligation.

☐ New Catalog No. 700 ☐ UNISTRUT Sample
☐ Wall Chart

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CITY_____ ZONE_____ STATE_____

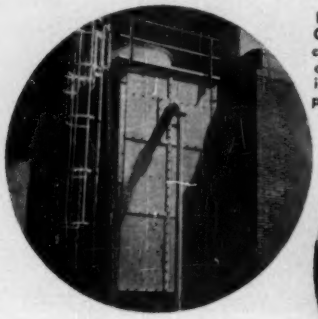
For Defense Production—Every day the value of UNISTRUT products is being proved by their use in Defense Industries and Armed Services installations where flexibility, assembly and erection speed count most.

The World's Most Flexible All-Purpose Metal Framing

the same engineering excellence

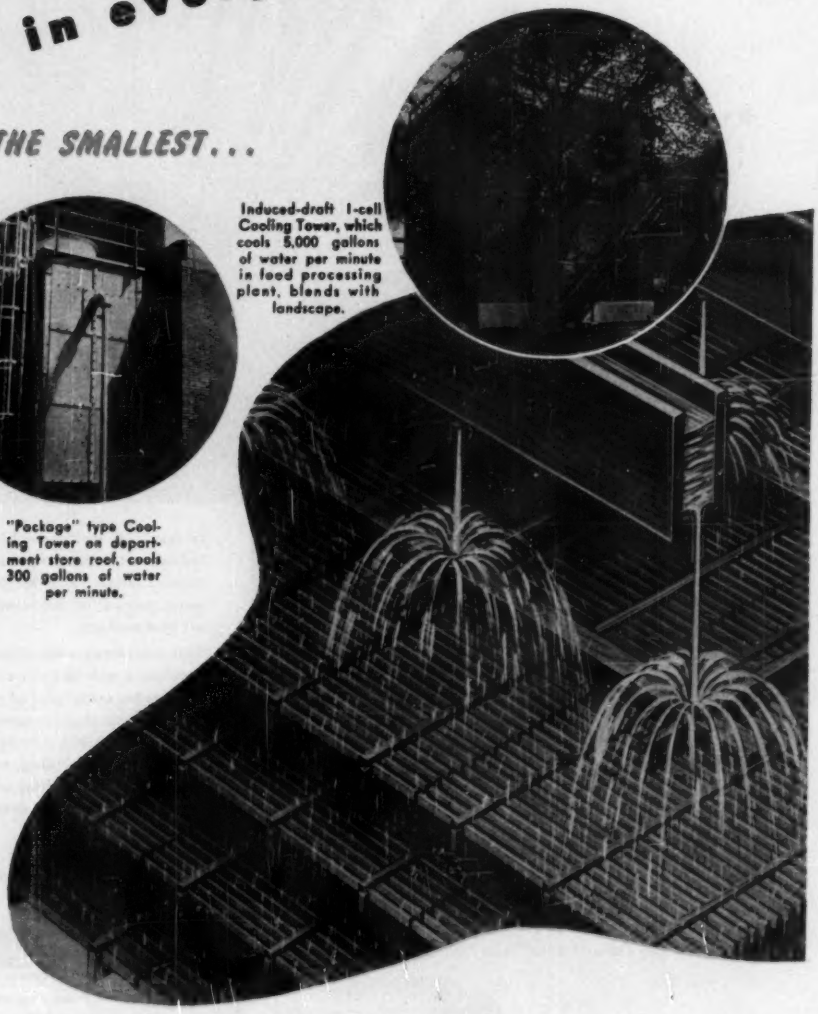
in every Foster Wheeler

FROM THE SMALLEST...



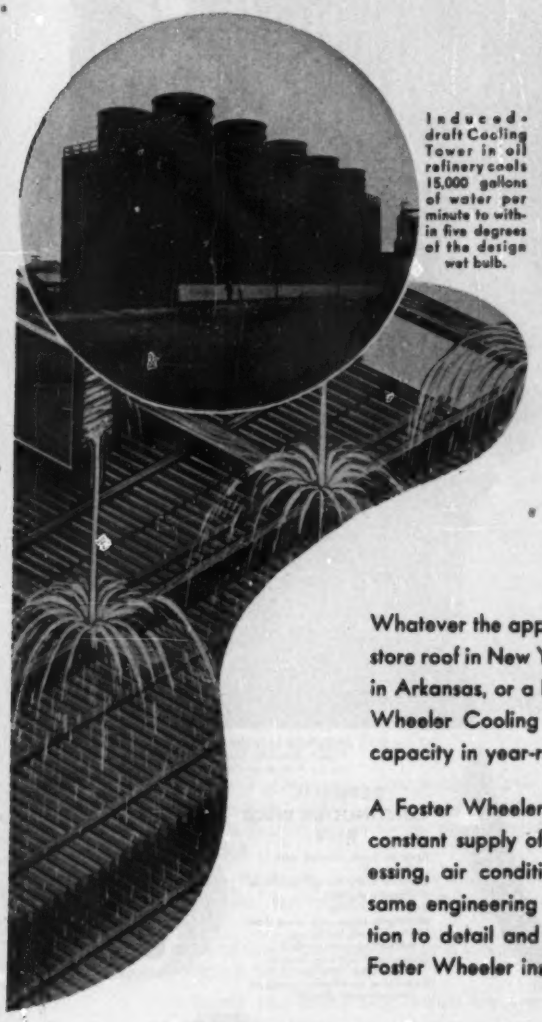
"Package" type Cooling Tower on department store roof, cools 300 gallons of water per minute.

Induced-draft 1-cell Cooling Tower, which cools 5,000 gallons of water per minute in food processing plant, blends with landscape.

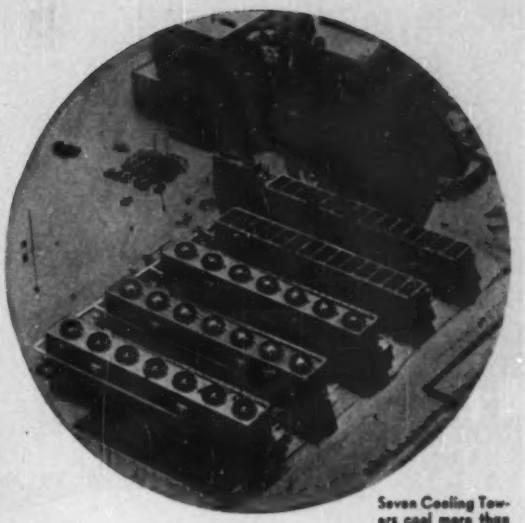


FOSTER WHEELER CORPORATION 165 BROADWAY

cooling tower



Induced-draft Cooling Tower in oil refinery cools 15,000 gallons of water per minute to within five degrees of the design wet bulb.



Seven Cooling Towers cool more than 180,000 gallons of water per minute in large power plant.

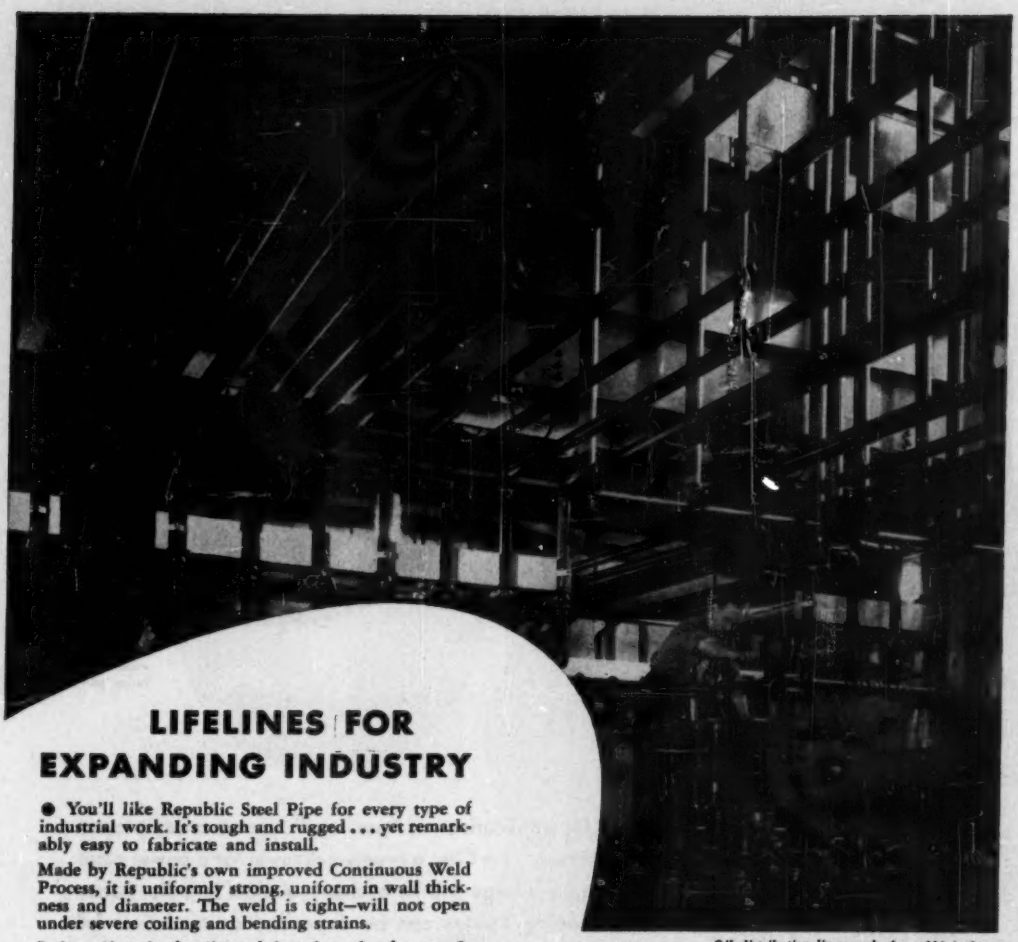
...TO THE LARGEST

Whatever the application—a "package" type on a department store roof in New York City, a twenty-cell tower for a power plant in Arkansas, or a large unit for a chemical plant in India, Foster Wheeler Cooling Towers can be depended on to deliver full capacity in year-round service.

A Foster Wheeler Cooling Tower is your best guarantee of a constant supply of cooling water for steam power plants, processing, air conditioning, or other uses. Regardless of size, the same engineering and construction excellence, the same attention to detail and the same quality of materials go into every Foster Wheeler installation.

NEW YORK 6, NEW YORK

FOSTER WHEELER



Oil distribution lines made from 1½-inch to 3-inch Republic Steel Pipe. Plumbing contractor is: Schweiser-Dippis Co., Cleveland, Ohio.

LIFELINES FOR EXPANDING INDUSTRY

● You'll like Republic Steel Pipe for every type of industrial work. It's tough and rugged . . . yet remarkably easy to fabricate and install.

Made by Republic's own improved Continuous Weld Process, it is uniformly strong, uniform in wall thickness and diameter. The weld is tight—will not open under severe coiling and bending strains.

It is uniformly ductile and free from hard spots. It bends freely and smoothly. It threads cleanly and accurately . . . and welds readily by all modern methods. It comes to you in easy-to-handle uniform lengths and in waste-saving extra long lengths.

Uniformly clean and commercially scale-free—both inside and outside—it insures against clogged valves and instruments in industrial lifelines.

You'll find a Republic Pipe Jobber wherever steel pipe is used. Check with your nearby jobber now about the industrial—and radiant heating—jobs you've lined up for later in the year. He'll give you the latest information on available sizes and current delivery schedules.

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GENERAL OFFICES • CLEVELAND 1, OHIO
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REPUBLIC CONTINUOUS WELD PIPE

Easy to bend, thread and close coil
Easy to weld by all methods
Uniformly ductile
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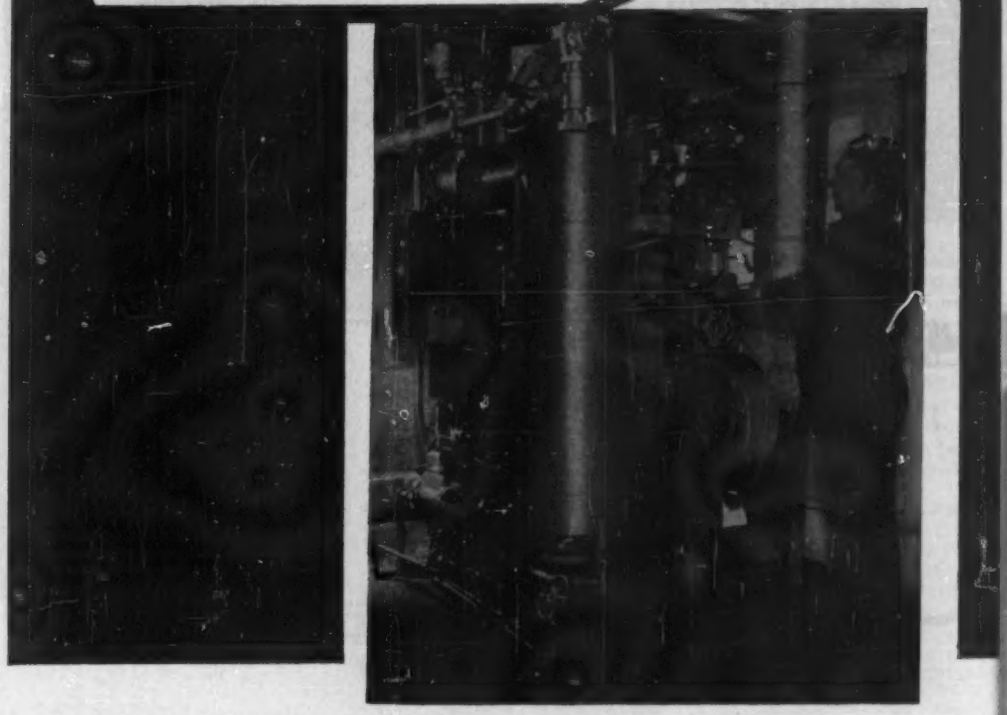
Uniformly clean and scale-free
Uniform wall thickness, diameter, concentricity
Economical uniform lengths, extra long lengths
Expansion co-efficient same as concrete and plaster

Republic STEEL PIPE IS FIRST CHOICE

REPUBLIC STEEL

More than a Package Boiler...
A PACKAGED STEAM PLANT



Do you need steam for...

...heating or processing... continuous or intermittent service (or both) – in unit capacities up to 6,000 pounds per hour – for pressures up to 300 psi?

...remote locations involving the expense of installing and maintaining long insulated pipe lines?

...an occasional load which may exceed the capacity of existing boilers?

...a highly fluctuating load which involves sudden heavy demands?

...conditions which require maximum output from minimum space, completely automatic operation and a minimum of attention.

• • •

If you do – if you have any one or a combination of these requirements – your best bet is the C-E Re-circulation Steam Generator. It's *more* than a package boiler – it's a complete steam plant including all controls and auxiliaries – a fully integrated unit. Investigate this unit before you buy any boiler in its capacity range. 8-507

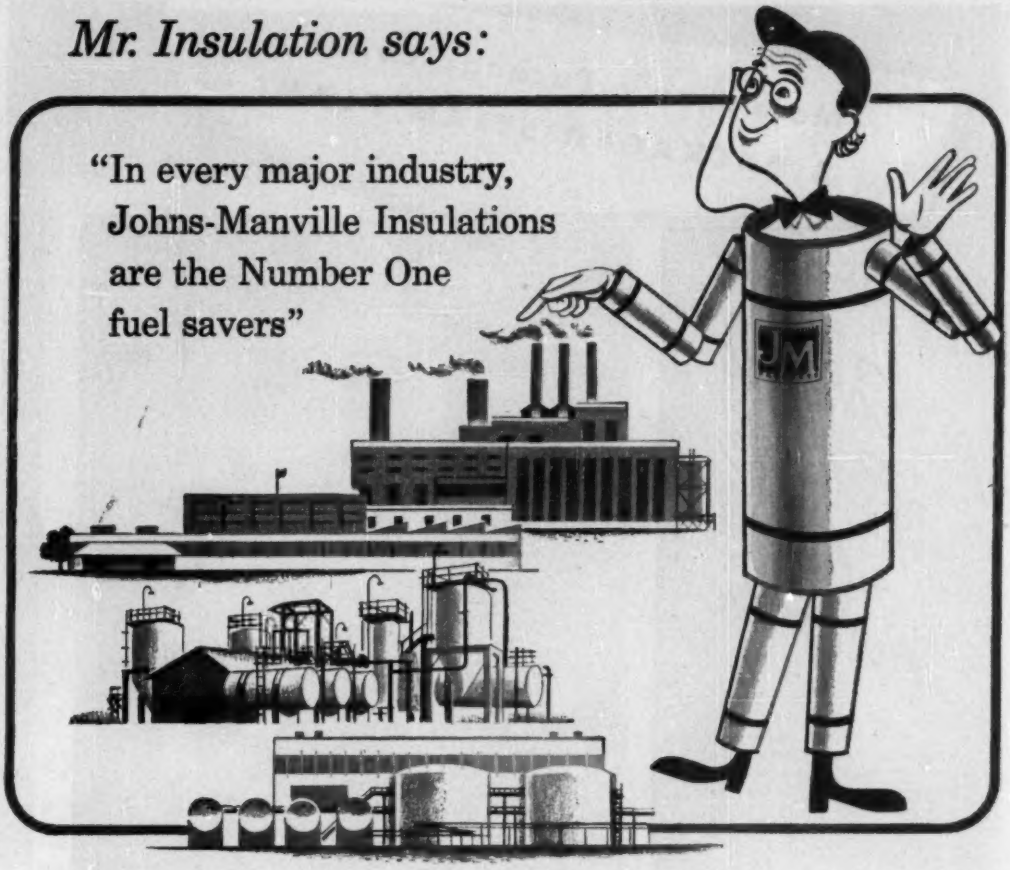
Send for recently issued bulletin p-323a

COMBUSTION ENGINEERING – SUPERHEATER, INC.

200 Madison Avenue, New York 16, N. Y.

ALL TYPES OF BOILERS, FURNACES; PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

Mr. Insulation says:



IN PLANTS with stacks or stills, tanks or towers, the story is the same—"Insulation by Johns-Manville" means the maximum return on your investment. There are two good reasons for this:

1. YOU GET THE RIGHT *MATERIALS*—From asbestos and other selected raw materials, Johns-Manville manufactures a wide range of industrial insulations for service from 400F below zero to 3000F above. If you need engineering advice in determining exactly the right one for your job, you can get experienced and authoritative assistance from your local Johns-Manville insulation engineer.

2. YOU GET THE RIGHT *APPLICATION*—Even correctly selected insulation needs proper application to permit it to serve at peak efficiency through the years. Here you can always count on J-M Insulation Contractors and their highly skilled mechanics. These organizations are trained in Johns-Manville application-methods, and have generations of insulation experience behind them.

Why not get the complete picture? Call on insulation headquarters when your next job is in the planning stage. Just write Johns-Manville, Box 290, New York 16, N. Y.

JM

Johns-Manville *first in* **INSULATIONS**

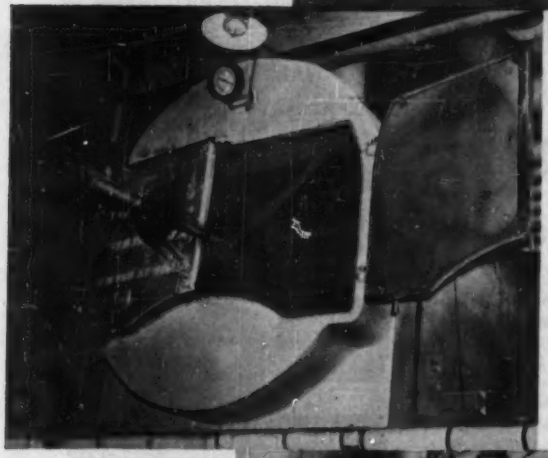
SAVE LABOR
•
SAVE FUEL
•
INCREASE BOILER CAPACITY

DIAMOND

AUTOMATIC

"AIR PUFF" SOOT BLOWERS

for Heating Boilers

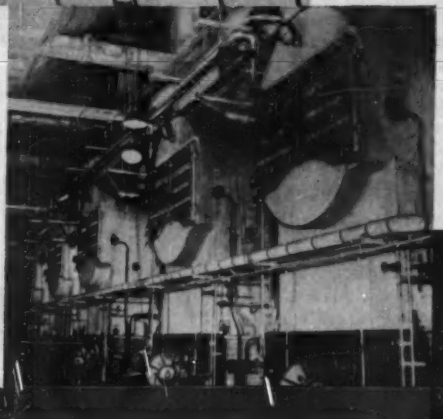


Accumulated soot in a boiler is a tremendous waster of fuel. Soot is an exceptional insulator . . . a very effective barrier to the heat. Cold rooms, higher fuel bills, general unsatisfactory operation are the result. Hand cleaning is inefficient, dirty, even dangerous.

Diamond A1E Automatic "Air Puff" Soot Blowers do a really efficient job of cleaning, without trouble, dirt, or nuisance. The boiler does not need to be taken off the line. The operator merely pushes a button and turns a valve . . . operation is automatic.

The Diamond "Air Puff" system is practically foolproof and is applicable to any number of boilers. For better heating, fuel saving, and a cleaner boiler room, investigate Diamond A1E Automatic "Air Puff" Soot Blowers. Write for Bulletin 897N.

▲ *Multi-Nozzle Element of A1E blower automatically rotates in a series of steps, blowing the entire tube bank. Cleaning is efficient—complete.*



◀ *Five fire tube heating boilers at large housing project are cleaned with Diamond Automatic "Air Puff" Soot Blowers.*

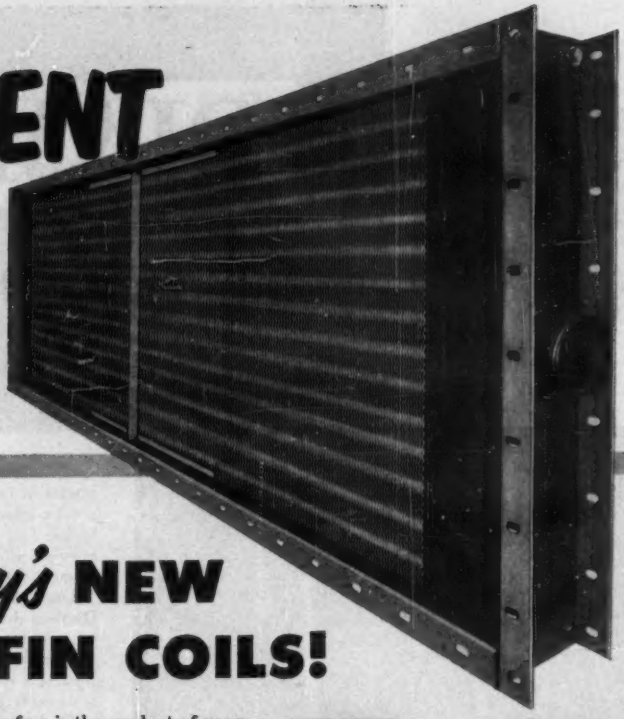
▼ *Small compressor and receiver supply all compressed air needed for battery of boilers shown at left.*

DIAMOND POWER SPECIALTY CORP.

LANCASTER, OHIO

DIFFERENT

and what a difference!

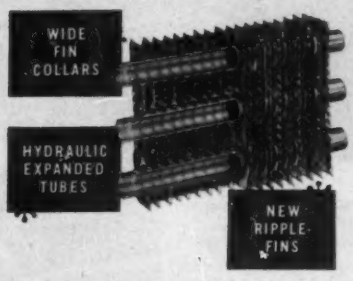


McQuay's NEW RIPPLE-FIN COILS!

McQuay's new ripple-fin surface is the product of years of research aimed at producing the ultimate in heat transfer for any weight of metal. High efficiency is assured by forcing the air to follow an ever-changing direction of flow in passing through the coil. Thus the air repeatedly contacts the coil surface to give maximum contact time, maximum contact velocity, and a resultant optimum heat transfer.

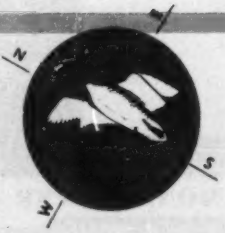
With this advance in design McQuay retains the staggered tube and the McQuay rippled edge features, so well known in the industry and which contribute greatly to higher heat transfer, construction ruggedness, and eye appeal.

McQuay heating (blast) coils are available in a wide variety of styles and sizes. Hot water, cold water, brine, direct expansion, and refrigerant condensing coils are also available for practically every type of application. Write McQuay Inc., 1601 Broadway St., N.E., Minneapolis 13, Minn. Representatives in all principal cities.



EXCLUSIVELY YOURS IN McQuay COILS!

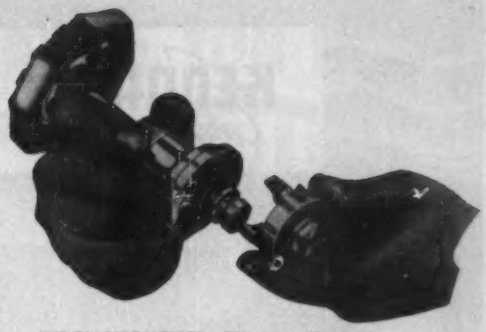
McQuay INC.



HEATING • AIR CONDITIONING • REFRIGERATION

KENNEDY

bronze globe valves...



SLIP-ON DISC HOLDER—This unique disc holder locks on securely with stem in wide-open position . . . yet releases by a half-turn of the stem when bonnet assembly is removed.

JOB-FITTED for longer service... easier maintenance

KENNEDY Fig. 89, Bronze Globe Valve, 150 lbs. steam, 300 lbs. WOG, non-shock

YOU KEEP MAINTENANCE COSTS DOWN with KENNEDY Bronze Valves because they are *job-fitted* . . . every valve specially designed and engineered for the job it has to do.

THE KENNEDY FIG. 89, for example, is designed for services where frequent inspection, cleaning of internal parts and quick renewal of the composition disc are required.

HEAVY UNION BONNET RING permits easy dismantling and re-assembly of the valve without risk of damage to body-bonnet bearing surfaces.

THE RENEWABLE COMPOSITION DISCS are available in a variety of materials to meet a wide range of fluid, pressure and temperature requirements.

RUGGED BODY has an unusually high seat to prolong disc life by utilizing full thickness of disc before disc-holder strikes the base of the raised seat.

LONG-WEARING PACKING—molded rings of lubricated asbestos—maintains easy operation and tight seal to prevent leaks. Valve can be repacked under pressure when wide open.

FOR BEST RESULTS and real economy, standardize on KENNEDY Bronze Valves . . . and the complete line of KENNEDY Iron Valves, Malleable, Cast-Iron and Bronze Pipe Fittings . . . WRITE FOR CIRCULAR 101.

BUY FROM YOUR LOCAL DISTRIBUTOR

KENNEDY JOB-FITTED VALVES

THE KENNEDY VALVE MFG. CO.
ELMIRA, NEW YORK

VALVES • PIPE FITTINGS • FIRE HYDRANTS

Heating and Ventilating Units

Air Volumes from 400 to 21,000 CFM

Kennard Heating and Ventilating Units are the answer to requirements of heating and filtering recirculated air, fresh air, a mixture of both, or for ventilation only. These ruggedly constructed and easily installed units, conventionally used for heating large spaces or as a central station unit to heat many small rooms, can also be utilized for a variety of special and process applications.

Wall - Floor - Ceiling Mountings

Pre-heat and Re-heat Coils - 1.1 to 32.5 sq. ft. face.

Moderate tip speeds and outlet velocities

Optional Equipment

Mixing Box and Dampers • Face and By-pass Dampers • Throwaway, Cleanable or High Velocity Filters • Target, Grid or Pan Humidifiers.

Representatives in Principal Cities

Write for name of nearest representative and complete information on Air Conditioning Blower Units— Finned Coils — Evaporative Condensers — Cooling Towers — Sprayed Coil Dehumidifiers.

KENNARD CORPORATION • 1817 S. HANLEY ROAD ST. LOUIS 17, MO., U.S.A.

IF IT'S PERFORMANCE YOU WANT

BUY FROM THE PEERLESS *Fluidyne* LINE...

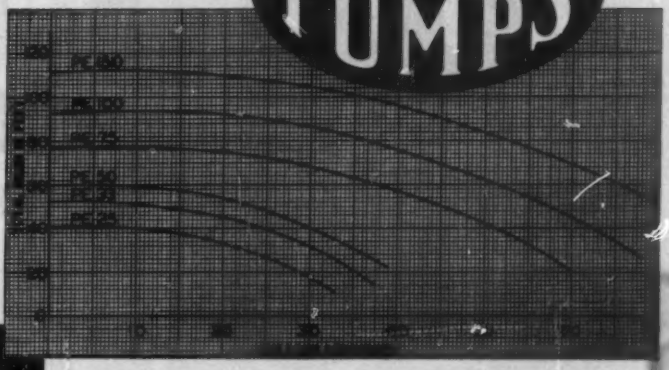
PEERLESS PUMPS

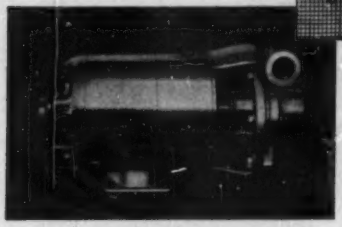
FOR FRACTIONAL HP PUMP USERS

HERE ARE THE RATINGS

HERE'S THE PUMP

PEERLESS *FLUIDYNE* TYPE PE PUMP ¼ TO 1½ H.P.





KEY TO CHART Performance chart showing head capacity characteristics of Peerless Type PE fractional hp Fluidyne pumps at 3450 rpm

KEY TO PUMP HP

PE 25—¼ hp
PE 33—⅓ hp
PE 50—½ hp
PE 75—¾ hp
PE 100—1 hp
PE 150—1½ hp

GET HIGHEST EFFICIENCY plus

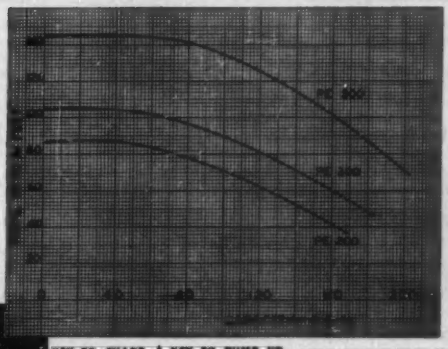
COMPACTNESS • ECONOMY DURABILITY *AND* EASY MAINTENANCE

FOR INTEGRAL HP PUMP USERS

HERE ARE THE RATINGS

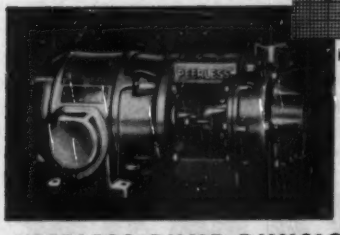
HERE'S THE PUMP

PEERLESS *FLUIDYNE* TYPE PE PUMP 2 TO 5 HP



Peerless offers in the Fluidyne line of end-suction horizontals, both electric and pulley-driven or flexible coupled models from ¾ hp to 150 hp. Capacity range: up to 5500 gpm; head range: up to 200 ft. New Bulletin B-2300 describes the line completely.

Mail Coupon Today!



KEY TO CHART Performance chart showing head capacity characteristics of Peerless Type PE integral hp Fluidyne pumps at 3450 rpm

KEY TO PUMP HP

PE 200—2 hp
PE 300—3 hp
PE 500—5 hp

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION

Address inquiries to Factories at:

Los Angeles 31, California and Indianapolis 8, Indiana

Offices: New York, Chicago, St. Louis, Atlanta, Dallas, Plainview and Lubbock, Texas; Fresno, Los Angeles; Phoenix; Albuquerque, New Mexico.

PEERLESS PUMPS FMC

Peerless Pump Division
Food Machinery and Chemical Corporation
301 West Avenue 26, Los Angeles 31, Calif.

Please send without obligation new Bulletin B-2300 describing Fluidyne line of fractional and integral hp pumps.

NAME_____

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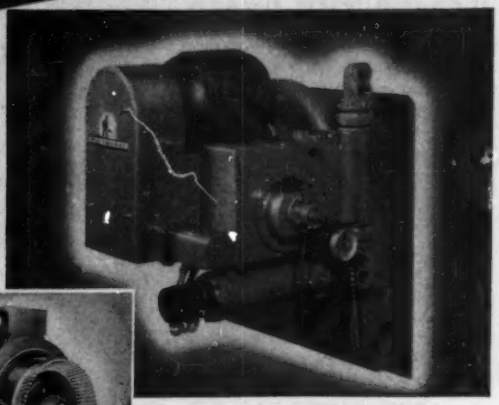
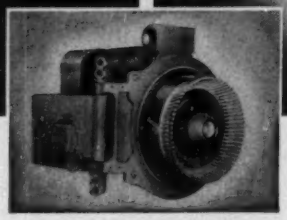
HPAC

from GAS to OIL

in a matter of *minutes*

and vice-versa





Above, the Iron Fireman Ring Type gas burner takes over the firing job, with the Iron Fireman Horizontal Rotary oil burner swung back from firing position on boiler front. Right, firing end of Iron Fireman combination gas-oil burner.

Above, Iron Fireman Horizontal Rotary oil burner in firing position. Removal of center plate in gas burner permits insertion of oil burner nozzle in center of gas ring. For long periods of oil firing, gas ring is customarily removed.

Meet fuel emergencies with IRON FIREMAN combination firing

Only a few minutes notice is required to switch from one fuel to another. The Iron Fireman gas-oil burner guards your buildings or plant against sudden fuel emergencies, or against daily or seasonal gas shortages due to peak demands. You may also take advantage of changing fuel prices or seasonal rates.

The Iron Fireman Ring Type gas burner operates equally well with natural, manufactured or mixed gas, or with forced or natural draft.

The Iron Fireman Horizontal Rotary oil burner fires any grade of oil without special adjustment, from lightest to heaviest (No. 6). The exclusive Iron Fireman Oil Volumeter maintains extremely accurate oil flow regardless of changes in oil viscosity. Heat-rich, low-cost industrial oils can be fired as easily as the refined domestic oils.

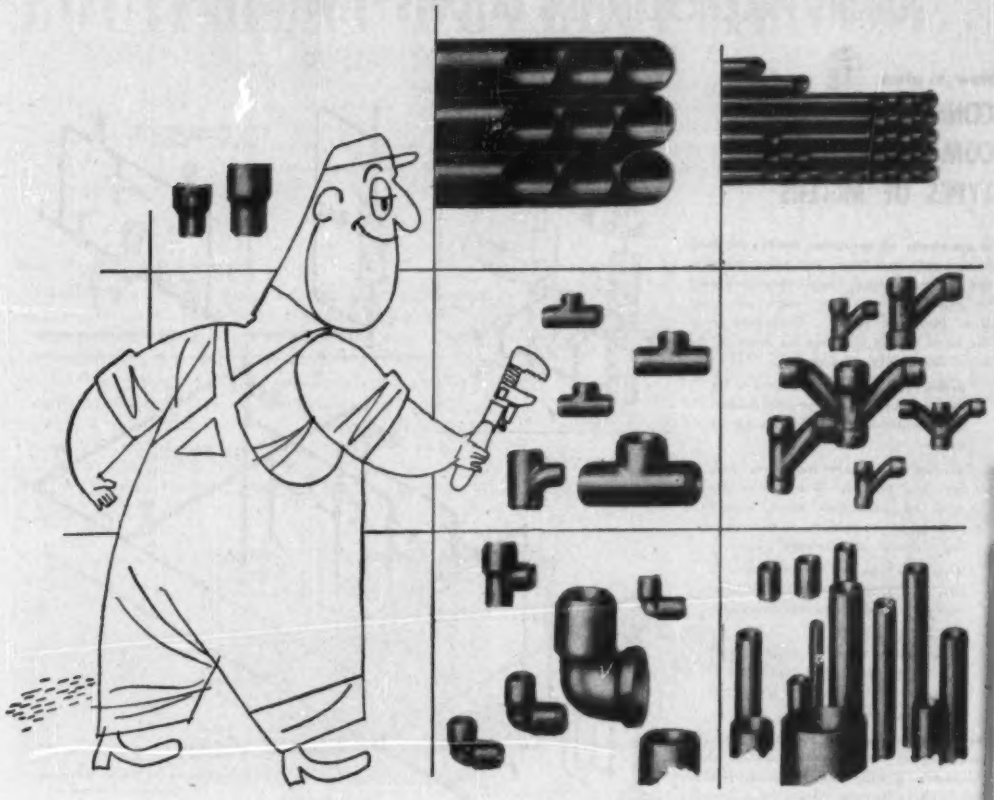
Every installation is engineered for most efficient application to your individual requirements. Sales and engineering service throughout U. S. and Canada.

Write for 16-page illustrated booklet and specification sheets, to Iron Fireman Mfg. Co., 3159 W. 106th St., Cleveland 11, Ohio. Other plants in Portland, Oregon; Toronto, Canada. Dealers everywhere.

IRON FIREMAN

OIL, GAS and COAL FIRING FOR POWER, PROCESSING OR HEATING

PIPE DREAM . . . 1951



Since the available supply of copper for non-defense work has become so limited, there just isn't a great deal we, or anyone else can do, these days, to fill your wants for MUELLER BRASS STREAMLINE copper tubing. We can say only this, for certain . . .

We can fill your orders for most STREAMLINE fittings.

We will not cut down quality of STREAMLINE fittings or tube regardless of material shortages.

We will do our best to help you solve any installation problem you ask us about.

As soon as copper becomes more plentiful we will be the first to see that you get the tubing and fittings you want. You can then make the kind of home, commercial and industrial STREAMLINE copper installations you know are the finest money can buy.

48

See your jobber for further information or write for catalogs S-351 and W-251 describing our complete line of STREAMLINE *wrought copper and cast bronze fittings.*

STREAMLINE PRODUCTS

MUELLER BRASS CO. PORT HURON 1, MICHIGAN

JENKINS PRACTICAL PIPING LAYOUTS

57

How to plan

CONNECTIONS FOR COMMONLY USED TYPES OF METERS

In practically all industries meters are used to compute, accurately and automatically, the amount of flow. Fluids measured may be liquid, gas, or vapor (water, oil, gasoline, fuel gas, steam). Diagrams show the basic piping hookups for some of the more commonly used meters.

Orifice Type — generally used to indicate, totalize, and record moderate quantities of liquids, gases, or vapors.

Venturi Type — also indicates, totalizes and records. It is frequently used on condenser water supply units in power stations, water pumping stations, and sewage plants.

Area Flow Type — or Rotameter is for indicating, principally, in lines carrying fluids in moderate quantities.

Displacement Meter — usually totalizes only; this is the type used to measure water supply from city mains to buildings.

Valve recommendations include bronze, for ordinary service, and stainless steel where corrosive liquids are handled. Jenkins Fig. 106-A Bronze Globe is especially suited for shut-off service as recommended in these hookups. Jenkins All-Iron Valves are also available where desired.

Consultation with meter manufacturers is recommended to determine the type best suited for your particular service.

A CHOICE OF OVER 500 VALVES

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering, select all the valves you need from the Jenkins Catalog. It's your best assurance of *lowest cost in the long run*. Jenkins Bros., 100 Park Ave., New York 17; Jenkins Bros., Ltd., Montreal.

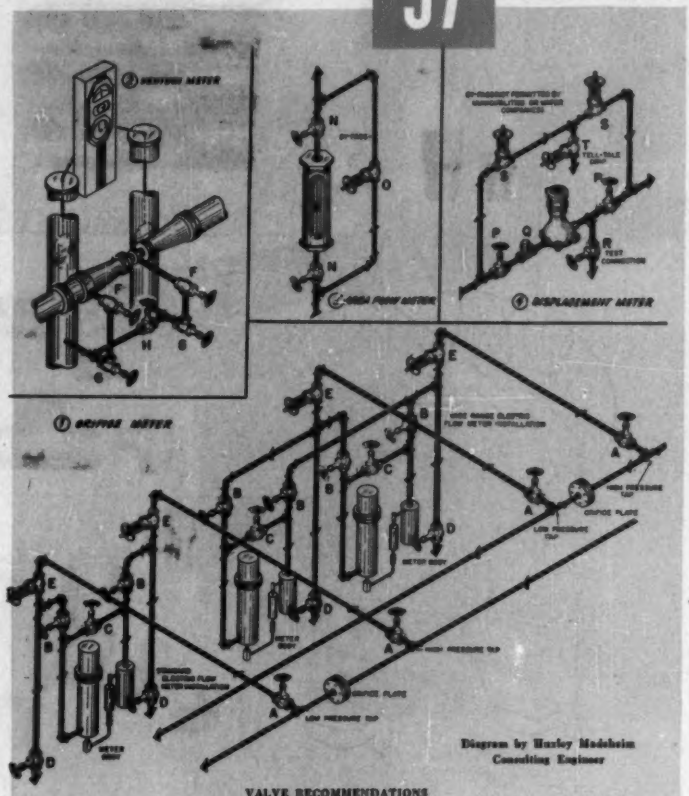


Diagram by Huxley Madeheim
Consulting Engineer

VALVE RECOMMENDATIONS

For details of valves to suit varying conditions see Jenkins Catalog.

	JENKINS VALVES					
	Code	Quan.	Bronze	Stainless		Service
ORIFICE METER	A	4	106-A	1308	Globe	Orifice Tap Shutoff
	B	6	106-A	1308	Globe	Meter Body Shutoff
	C	3	741-G	1308	Globe	Equalizing Line
	D	4	106-A	1308	Globe	Drain & Blow Down
	E	4	47-U	1302	Gate	Main Shutoff or Meter
VENTURI METER	F	2	108-A	1310	Angle	Piezometer Tap Shutoff
	G	2	108-A	1310	Angle	Tap Shutoff to Water Cock
	H	1	741-G	1308	Globe	Equalizer
AREA FLOW METER	N	2	106-A	1308	Globe	Meter Shutoff
	O	1	47-U	1302	Gate	By-Pass
DISPLACEMENT METER	P	2	47-U	1302	Gate	Meter Shutoff
	Q	1	92	1328	Check	Anti Back Flow
	R	1	106-A	1308	Globe	Test Connection
	S	2	47-U	1302	Gate	By-Pass
	T	1	47-U	1302	Gate	Tell Tale Drip

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COMPLETE DESCRIPTION AND ENLARGED DIAGRAM OF THIS LAYOUT FREE ON REQUEST. Includes additional detailed information. Simply ask for Piping Layout No. 57.

Jenkins Bros

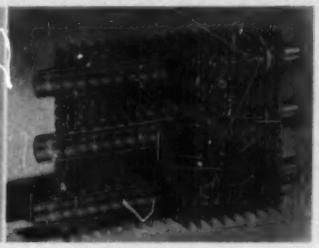
EQUIPMENT DEVELOPMENTS...

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January 1951 Heating, Piping & Air Conditioning and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk, equipment and manufacturer not listed.

Gas Fired Unit Heaters

HPAC 1*—Gas fired unit heaters, small and lightweight, designed for rapid response to thermostatic control (use of stainless steel reduces time required for tube warmup) — Modine Mfg. Co., Racine, Wis. Heat exchanger tubes are die-formed to provide their own individual combustion chambers, and each tube is individually fired, making it possible to heat all tubes evenly, the manufacturer states. The burners are offered in five sizes ranging from 65,000 to 165,000 Btu per hr input. The 105,000 Btu per hr model (illustrated) weighs 106 lb, is 30 in. high, 21¾ in. wide and 12½ in. deep.

Heater



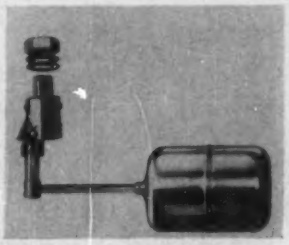
Steam Coils

Steam Coils

HPAC 2—Steam coils with rippled, plate type, aluminum fins which produce a rippled air flow pattern designed to create maximum heat transfer — McQuay, Inc., 1600 Broadway, N.E., Minneapolis 13. The rippled tubes create steam turbulence with increased internal coefficients, and are staggered on 2 row coils to give maximum air side heat transfer, the manufacturer states. The ripples are intended to assure permanent fin-tube bond through greater flexibility under expansion and contraction. Coils are available in two types—the "Jet" double tube type for applications requiring modulated steam control with uniform discharge temperatures and protection against freeze-up, and the standard coils which are especially suitable for use as reheaters and boosters.

Float Operated Valve

HPAC 3—No. 18 series float operated liquid level control valves in three models, including one for protection against backsiphonage (shown) with float mounted at right angles to the valve, which is kept above water level; and another for external applications, as on humidifiers (float and valve in a die cast chamber)—McDonnell & Miller, Inc., 3500 N. Spaulding Ave., Chicago 18. The valve opens to full capacity with only a small float drop, and closes tightly against supply pressures up to 100 lb, the manufacturer states. The capacity ranges to approximately 1500 gph. depending on supply pressure. All parts, except for the neoprene seat, are of copper or brass, and the assembly is held together by a single brass pin. The valves can be used on evaporative coolers, hygrometers, humidifiers of warm air furnaces, etc.



Valve

Regulator

Self Contained Temperature Regulators

HPAC 4**—Self contained temperature regulators operating on the principle of a bellows motor which derives its power from the pressure generated by the vaporization of a volatile liquid—Warren Engineering Co., Broadway, N. J. Included in the line are regulators for fluids in open or closed tanks and other vessels; for fuel oil pre-

FOR YOUR CONVENIENCE {12-51}

Heating, Piping & Air Conditioning
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Recent Trade Literature

(Circle each HPAC number in which you are interested)

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23							
101	102	103	104	105	106	107	108	109	110
111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130
131	132	133	134	135	136	137	138	139	140
141									

Name ..... Title .....

Company .....

Address .....

City ..... Zone ..... State .....

heaters, instantaneous hot water heaters, and similar applications; a lever and weight type controller; a three-way mixing or bypass valve; a reverse acting regulator; and single seated pilot operated regulators.

Bus and Truck Parking Lot Heater

HPAC 5—Oil fuel parking lot heater for protecting bus and truck motor blocks from freezing—Vapor Heating Corp., 80 E. Jackson Blvd., Chicago 4. The heater is housed in a 4 x 4 ft metal building, and weighs 1500 lb. It puts out 250,000 Btu per hr, enough heat to protect 10 buses or 20 trucks, the manufacturer states. Inlet hot water hoses are attached to the motors with snap connector fittings, with one inlet and one outlet connection per vehicle usually being sufficient. One 1½ hp electric motor operates the circulating pump for the system, the hot water heater, the forced draft blower, and fuel pump of the heater. A circulating pressure of 15 lb is maintained. When the circulating water temperature drops to 140 F, the heater automatically fires up and continues to operate until the water reaches 170 F. The heater uses about 2½ gph of fuel oil.

Heater

Spray Cooler

Spray Cooler

HPAC 6—"No Frost" spray cooler for refrigeration and refrigerated storage of products which may be damaged by cold, dry air—Niagara Blower Co., 405 Lexington Ave., New York 17. Air enters through the fans and is blown through the units. It passes over refrigeration coils and through a spray of liquid solution which prevents the condensation of water and the formation of ice or frost on the coils. The chilled air, which may be as low as —20 F, passes from the spray chamber into the room, and contains no reheat from the energy of the fans, the manufacturer states.

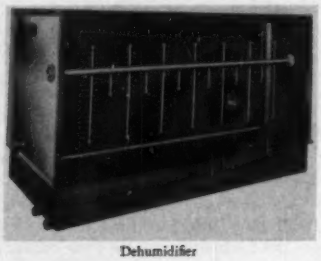
Odor Neutralizer

HPAC 7**—"Renovair" non-toxic liquid which uses elements found in plant life to neutralize odors in industry, institutions, etc., as it evaporates into the surrounding air — Boyle-Midway, Inc., Correctair Div., 22 E. 40th St., New York. It contains no perfume to mask odors, nor does it deaden the sense of smell, the manufacturer states. It is used with the company's gyrostatic evaporator, which is powered by the flow of air through the unit. For non-air conditioned spaces, other types of dispensers are available.

Gas-Fired Heating Boiler

HPAC 8—"Packet" automatic heating unit, formerly only oil-fired, now available with an AGA listed and certified burner for use with natural, mixed or manufactured gas—National Radiator Co., 221 Central Ave., Johnstown, Pa. The unit contains a steel boiler, a tankless or storage type heater for domestic hot water supply, controls for hot water space heating, and other regulating devices, in addition to the burner. It is designed for small to medium heating loads, and has an SBI net rating of 77,000 Btu per hr with 510 sq ft of water radiation.

Boiler



Dehumidifier

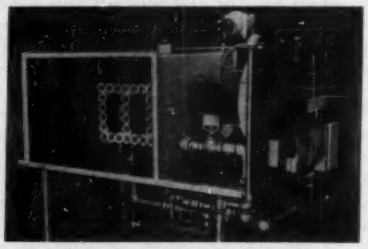
Sprayed Coil Dehumidifiers

HPAC 9*—Sprayed coil dehumidifiers, affording continuous supply of washed air and utilizing wetted surface of cooling coil for heat transfer—Kennard Corp., 1819 S. Hanley Rd., St. Louis 17. Units are available in a variety of sizes, and are of galvanized construction, with copper tube and copper finned coils. They may be used as evaporative coolers for off season loads.

Warm Air Make-up Unit for Industrial Paint Spray Booths

HPAC 10**—Experimental unit designed to meet irregular demands for heat and air replacement in industrial paint spray booths—Burdett Mfg. Co., 3433 W. Madison St., Chicago 24. The unit was developed by C. E. Fitzgerald, who is associated with the company.

Industrial users of paint spray booths have long realized that undesirable conditions exist because of the negative pressures developed by exhaust blowers. Many paint spray booths are installed in confined areas with no provisions for replacing air exhausted by the spray booth



blowers. In many cases when make-up air is adequate in the original installation, additional paint spray booths and increased quantities of air removed are not compensated for.

Operating a paint spray booth under a negative pressure has many disadvantages, the principal objection being that the blowers, designed to move a given quantity of air at a predetermined intake pressure, apparently fail to do the job because the operating conditions are not the same as

(*Continued on Page* 168)

Hot Fumes at Hotpoint

EXHAUSTED EASILY... EFFICIENTLY

ABOVE: 10 DeBothezat Bifurcator Fans, with Haveg housing, on the roof of Hotpoint's washing machine plant in Chicago.

RIGHT: Hotpoint washer tubs get a hot sulphuric acid bath in these tanks before porcelain finish is applied.

If corrosive fumes from cleaning and pickling tanks pose a problem for you, take a tip from Hotpoint's experience. Hotpoint uses a ventilation system that pulls hot sulphuric acid fumes and alkali fumes laterally across cleaning tanks away from working areas and up into wooden ducts. In addition to protecting workmen and equipment, this lateral ventilation system also permits clear work space and much better light over the tanks. Fumes are exhausted by 10 DeBothezat Bifurcator Fans, with Haveg housings, which are installed on the roof.

HOW BIFURCATOR FANS WORK

The DeBothezat Bifurcator is a direct motor-driven fan with a divided housing. Motor is mounted in a separate chamber, open to the air but isolated from destructive fumes which are by-passed (bifurcated) around it. Bifurcators can be constructed with housing made of Haveg (a phenol-formaldehyde plastic) as illustrated here, or they can be made of carbon steel, stainless steel, monel metal, with lead or rubber lining and many other materials.

FREE 32-PAGE BULLETIN

"Design Data for Lateral Tank Ventilation." Contains data for standard 2-sided tank enclosure, rear manifold exhaust and for "push-pull" operation. Fan charts showing capacity, pressures, duct lengths in feet and CFM for various types of tanks. Ask your DeBothezat Fans representative for a copy or write our factory, Dept. HPB-12.

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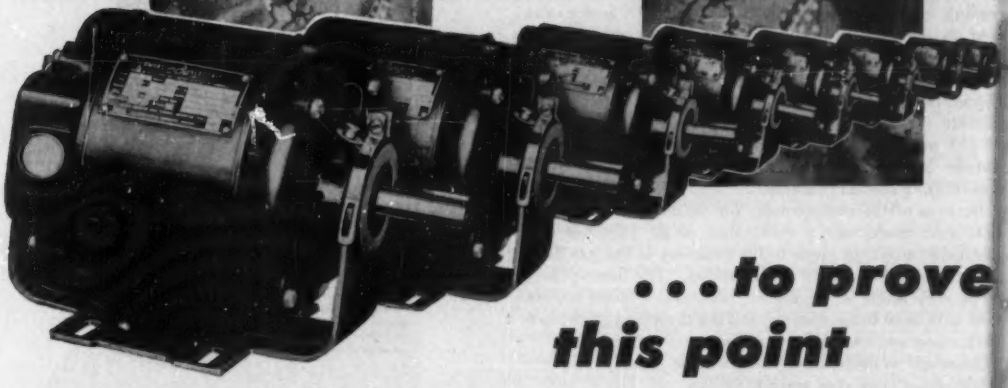
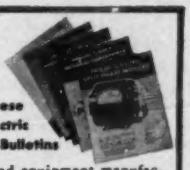
Two are Better Than One



. . . to prove this point



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- ☐ 181-B Split-Phase
- ☐ 181-C Integral
- ☐ 181-D Fan-Duty
- ☐ 181-E Oil-Burner
- ☐ 181-F Jet Pump
- ☐ 181-G Blower

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EMERSON ELECTRIC
MOTORS • FANS — APPLIANCES

(*Continued from Page 164*)

design conditions. Reduced intake pressures result in inefficient, low capacity blower operation. The booth cannot keep the overspray enclosed, resulting in the settling of the paint spray throughout the general area. This negative pressure in the room or building also causes drafts from all sources and a "wind tunnel" is created in passageways and halls, carrying dirty air on from other areas into the spray room, which all must pass freshly painted work on its way out.

In the winter, negative pressures cause abnormal infiltration of cold air, placing an additional load on the building heating system. Hence, the problem is not only one of replacement of exhausted air but also of heating that air.

Because of the intermittent operation of most paint spray booths, and the corresponding changing quantities of air being exhausted, a system for meeting these irregular demands for heat and air replacement is desirable.

A solution is offered in the new experimental unit. A 600 cfm pilot model of the unit has been tested at the Michigan Consolidated Gas Co. laboratory, Detroit. Air can be delivered with a 90 F temperature rise, bringing —10 F air up to 80 F at the booth or in the room.

The open flame method of heating air is used. A direct reading continuous sampling indicating CO device was used in the tests, which were made at air velocities of from 800 fpm to over 2200 fpm over the entire throttling range of the gas burners. Samples were taken as close as 1½ in. from the face of the burner, and only at "full-rich" mixture (a flame about 10 in. long) was there indication of CO present. These findings were confirmed by the Bureau of Industrial Hygiene for the City of Detroit, according to the manufacturer.

Because of the requirements for variable air quantities, tests were made over a wide range of air velocities with particular attention given to the behavior of the gas flame at extreme high and low air velocities. The flame proved to be very stable at the higher velocities, a factor uncommon with most flame systems, and the throttling mechanism performed well over the entire range.

Standard units in three sizes will be made available—6,000 cfm, 12,000 cfm, and 24,000 cfm.

Steel Vise

HPAC 11**—Portable (28 lb) all-steel "Multi-Vise," which can be used as pipe vise, pipe wrench, C clamp, and milling jig — American Implements, Inc., 2523 Taylor St., Omaha. It is available with 360 degree vertical, horizontal, or double swivel (both horizontal and vertical). The jaws are removable and replaceable, and have a capacity of 6 in. square, 5¾ in. round.

Controller for Magnetic Drives

HPAC 12—"E-M Regutron" magnetic amplifier control used with variable speed magnetic drives for controlling speed to within plus or minus 0.5 percent of speed called for—Electric Machinery Mfg. Co., 1331 Tyler St., N.E., Minneapolis 13. The control is a saturable core reactor amplifier system using non-moving parts, and no electronic circuits are needed. Sensitivity is obtained through a current amplification ratio of approximately 20,000 to 1, the manufacturer states.

A fan for every need

from

HERMAN NELSON

Direct Drive Unit Blowers *are available in 11 models. Wheel size from 6" to 11". Choice of speeds available in each size. These units may be mounted on floor, wall or ceiling.*

Belt Drive Propellet Fan. *These versatile units deliver maximum amount of air effectively . . . quietly. Operate horizontally or vertically. Wheel diameters from 24" to 54". Capacities up to 36,000 c.f.m.*

Centrifugal Fans for every Class I or Class II use. *Equipped with statically and dynamically balanced air wheels of most advanced design. More than a hundred sizes and speeds. Extra quiet in operation.*

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All Herman Nelson Centrifugal Fans and Unit Blowers are available for any discharge and rotation. Weatherproof covers, vibration dampeners, access doors, drain connections, inlet screens, inlet vane control, outlet dampeners and acid resistant finish available.

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Write for detailed information about any type Herman Nelson Fan to Dept. HP-12.

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Here is the most diversified line of packaged centrifugal fans available. There are 103 models with capacities from 360 to 18,300 c.f.m. There are direct drive, belt drive, slow speed and non-overloading types, each carefully designed to do a specific job well. More and more architects, engineers and contractors are specifying and installing Herman Nelson Unit Blowers for the wide range of models insures a unit of the exact capacity needed. Herman Nelson Unit Blowers are compact, easy to install and have inherent ability to deliver or exhaust large quantities of air efficiently.

Herman Nelson Unit Blowers pace the field because constant engineering development and research has resulted in functional, highly efficient units—the result of 45 years of experience in the production of heating and ventilating equipment.

You can judge a unit blower by its fan wheel

The heart of every unit blower is its fan wheel and here is where Herman Nelson superior engineering shows up. All the latest findings of aerodynamic science are put to work in the design of these fan wheels.

Every fan wheel installed in Herman Nelson Unit Blowers is statically and dynamically balanced before assembly. After assembly, the entire unit is carefully tested at the speed it is to operate within the system. It is also tested at maximum recommended speeds.

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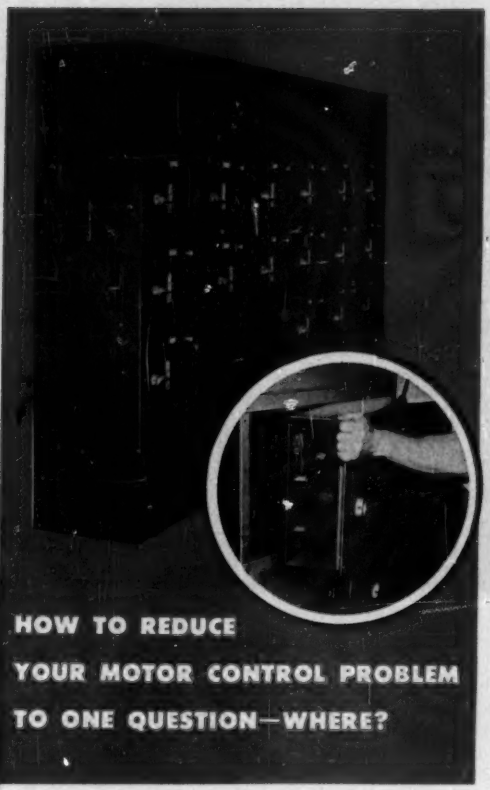
MOLINE, ILLINOIS



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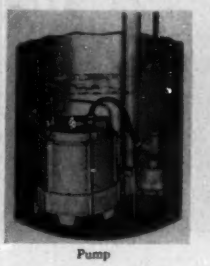
Submersible Utility and Sump Pump

HPAC 13**—Completely submersible model P-109 MA utility pump for sump usage, and for draining flooded areas, tanks and vats, and similar applications—Kenco, Inc., 1125 North Ridge Rd., Lorain, Ohio. The automatic liquid level control switch eliminates the need for a float, and has no moving parts exposed to water. It turns the pump on when air pressure is created by water which rises in the switch skirt and moves a diaphragm which in turn trips the switch. Pumping action sustains switch operation, making it possible to pump a sump dry within $\frac{5}{8}$ in. of the bottom, the manufacturer states. The 1/3 hp motor is hermetically sealed in oil, and the pump, weighing 50 lb., is rated at 3300 gph.



Pump

Diffuser

Air Diffuser

HPAC 14**—"Flexiflo" air diffuser, in which the blades can be shifted to any position, up or down, from closed to fully open, providing a variable effective area—Universal Diffuser Corp., 890 Whittier St., New York 59. It consists of an outside spun aluminum cone which acts as a finishing ring, and a diffuser comprising a conical spiral in which the continuous blades are elastically held together with radial spokes. The spiral is centrally connected to a cross bar by a thread rod, which, when turned, shifts the position of the blades. The large peripheral leading edge creates a number of tip jets which produce a rapid mixing effect, the manufacturer states. The deflector vanes, independently movable, can be adjusted to any position from the outside.

Steam-Water Heaters

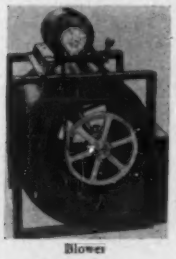
HPAC 15—"Cox" direct diffusion, packed column, instantaneous steam-water heaters — O'Brien Steam Specialty Co., Inc., Syracuse 2. In tests conducted by Syracuse University, the "Baby" heater ($\frac{1}{2}$ in. connections) delivered 3.6 gpm at 100 deg temperature rise and 100 lb steam pressure. In the "Junior" model (in five sizes from $\frac{3}{4}$ to 2 in.), the $\frac{3}{4}$ in. size, rated at 10 gpm, delivered 13.8 gpm at 100 deg temperature rise and 80 lb steam pressure. The heaters are manually operated.

Heat Pump

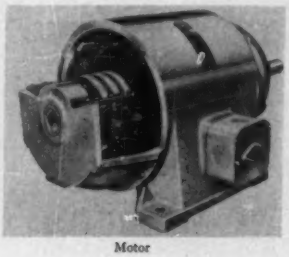
HPAC 16*—Packaged "Prop-R-Temp" heat pump employing an electrically operated changeover valve controlled by a selector switch which causes the unit to heat or cool at will—Typhoon Air Conditioning Co., 794 Union St., Brooklyn 15. The pump, which has been tested in Florida, is produced in sizes ranging in capacity from 2 to 20 tons, and is similar in appearance to the company's standard packaged unit. In many cases, however, the plenum chamber is replaced by duct connections.

Blowers

HPAC 17—"Massachusetts Universal" Type N blowers which can be set up in any discharge — bottom horizontal (illustrated), top horizontal, upblast, and downblast — if position of the oil cup is changed — Bishop & Babcock Mfg. Co., 4901 Hamilton Ave., N. E., Cleveland 14. Blowers are now available in wheel diameters of 7 to 16½ in, and will fit all standard motor frames. The rotation of double width blowers can be changed by moving the shaft, and twin blower assemblies are available which have built up air conditioning units.



Blower



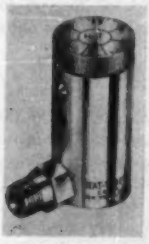
Motor

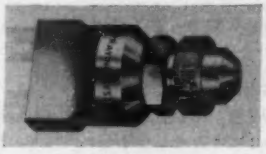
Slip Ring Motor

HPAC 18—Slip ring motor featuring new arrangement of collector rings and brush assembly which permits their complete housing in the motor's regular end bell and reduces overall dimensions to those of a standard squirrel cage motor—Reuland Electric Co., 3001 W. Mission Rd., Alhambra, Calif. The use of flat end bells permits brakes and other equipment to be attached on either end using face or flange type mountings. Motors are available in ratings of from ¾ to 15 hp, or, in conjunction with gear reducers, from ¾ to 5 hp.

Thermostatic Radiator Valve

HPAC 19*—Redesigned radiator valve with dial setting for obtaining desired room temperature—Heat-Timer Corp., 520 Broadway, New York 12. The valves are applicable to low pressure, one pipe steam systems, and require no alteration of existing boiler controls.





Left: Valve
Above: Nozzle

Pneumatic Atomizing Nozzle

HPAC 20—"⅛ JBC" pneumatic atomizing nozzle which permits connected piping to be in line with direction of spray—Spraying Systems Co., 3219 Randolph St., Bellwood, Ill. It is designed for applications where space is limited and where the nozzle must be mounted in a projected position in relation to the material to be sprayed. The two pipes in back of the nozzle can be used as a handle for portable operation. Assemblies include pressure and siphon setups, for producing round, flat, and wide angle round sprays.

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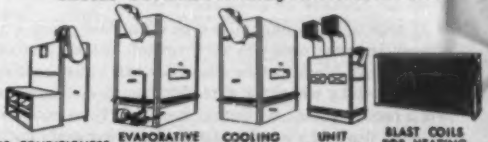

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Work-Saver Pipe Tools

High Velocity Air Filter

HPAC 21—"Airsan Viro-Crimp" air filter, designed to operate with maximum efficiency at face velocities of 300 to 500 fpm—Air Filter Corp., 108 N. Water St., Milwaukee 2. The viscous core is constructed of horizontal layers of galvanized wire mesh (illustrated) so arranged as to assure a large filter area with no appreciable pressure drop, the manufacturer states. There is no direct opening in the media. The air flows into divided channels, being baffled by a filter wall. Drain slots facilitate drying and cleaning.

Filter

Air Drier

Electric Air Drier

HPAC 22—Air drier, in 8000 and 14,000 cu ft sizes, for offices and other commercial installations — Kauffman Air Conditioning Co., 4505 Olive St., St. Louis. It is plugged into a 115 volt, 60 cycle, a-c outlet, and operation requires no adjustment of controls. The unit, which utilizes "Freon", reheats the air before returning it to the room.

Heat Transfer Equipment

HPAC 23**—Liquid phase heat transfer equipment designed to operate at temperatures up to 800 F—American Hydrotherm Corp., 33-70 12th St., Long Island City 6, N. Y. Includes coal, gas or oil fired boilers with capacities up to 20,000,000 Btu per hr; centrifugal pumps rated up to 1600 gpm; and package units, mounted on a common frame, and utilizing electric heaters with capacities from 3 to 75 kw, or gas heaters with ratings of 250,000 to 1,000,000 Btu per hr. Circulating pumps for the units are available in sizes of 1½ to 120 gpm.

EQUIPMENT BRIEFS

ELECTRONIC TEMPERATURE MONITOR SYSTEM designed to automatically and continuously monitor up to 270 separate processing temperature points — Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Wayne & Windrim Aves., Philadelphia 44. The system, which includes an audible alarm, records only those temperatures which deviate beyond a preset limit. It is applicable for steam generating stations, in synthetic fiber manufacturing, and chemical, petroleum and other processing industries.

"Hi-Temp" *HEAT RESISTANT ALUMINUM PAINT*, designed to withstand temperatures up to 1200 F without peeling, discoloring or blistering—Illinois Bronze Powder Co., 2023 S. Clark St., Chicago 6. Formulated of pure aluminum powders in a newly developed vehicle, the paint can be applied to boilers, ovens, furnace fronts, etc., by brush or spray.

Air-conditioning ducts in the new Moses H. Cone Memorial Hospital, Greensboro, N. C., are insulated with FOAMGLAS. Here, workmen are applying a finish over the insulation. Insulation Contractor: Starr Davis Company, Inc., Greensboro, North Carolina.

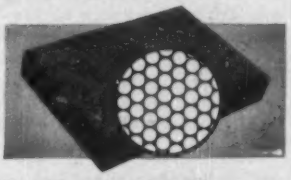
Long service . . . on long ducts

● It's the way it is made and what it is made of that give FOAMGLAS its long lasting insulating effectiveness.

The still air sealed in its cellular structure guarantees the insulating efficiency of FOAMGLAS. And the cells are glass, which has unusually high resistance to elements that destroy other insulating materials. So FOAMGLAS retains its *original* insulating properties for years on end, without costly additional vapor or moisture-proofing, without frequent maintenance, repairs or replacement.

These are the main reasons why so many users believe that FOAMGLAS is the most effective and economical insulation on the market . . . for walls and floors, roofs and ceilings . . . for piping, valves and fittings . . . for ducts and other air handling equipment.

Want more detailed information? Just send in the coupon and we'll gladly send you a sample of FOAMGLAS and a free copy of our latest fact-filled booklet.



The best glass insulation is cellular glass. The only cellular glass insulation is FOAMGLAS. This unique material is composed of still air, sealed in minute glass cells. It is light weight, incombustible, vermin-proof. It has unusually high resistance to moisture, chemicals and many other elements that cause insulation to deteriorate.

PITTSBURGH CORNING CORPORATION
PITTSBURGH 22, PA.

PITTSBURGH PC CORNING

FOAMGLAS® *the cellular glass insulation*

When you insulate with FOAMGLAS — the insulation lasts!

Pittsburgh Corning Corporation
Dept. AF-121, 307 Fourth Avenue
Pittsburgh 22, Pa.

Please send me without obligation, a sample of FOAMGLAS and your FREE booklet on the use of FOAMGLAS for Piping and Process Equipment.

Name.....

Address.....

City.....State.....

—and for help with the temperature control, we'll talk to Honeywell!

It's plain to see cartoonist Sam Cobean's wacky characters have their own ideas on how to inspect a home.

But in *one* thing, at least, they're like everyone else—they place a high value on comfort. Moreover, they know you can't have real comfort without proper temperature control. And they know where to go for help with *that*.

Honeywell *can* help heating engineers and contractors provide the proper thermal environment for any client—anywhere—in any kind of structure. We have a lot of well informed control engineers—in our 91 different offices—who are experienced in doing just that. And we have a lot of literature that's yours for the asking—on the automatic control of heating, ventilating and air conditioning.

So, why not *talk to Honeywell?* Why not *write to Honeywell* about *your* control problem? And why not do it *now?*

For more information on how the Honeywell organization can help you solve your control problems, see the column across the page.

MINNEAPOLIS **Honeywell**

First in Controls

WE HEAR THAT . . .

THE AIR-MAZE CORP., Cleveland, has purchased the *DETROIT AIR FILTER CO.* of Woodstock, Ill. Manufacture of the company's filters will be continued at Woodstock.

With more than 1500 in attendance at a recent "open house," *CHICAGO STEEL SERVICE CO.* officially opened its new general offices and warehouse. Located on Kildare Ave. at 45th St. in Chicago, the structure covers 120,000 sq ft and was built at a cost of $1,500,000.

A new professional society, to be known as the *HUMIDIFIER ASSOCIATION*, recently has been formed. The executive committee includes *MARION LEVY*, Viking Air Conditioning Corp., *ARTHUR EVANS*, Skuttle Mfg. Co., *JACK CARR*, Maid-O'-Mist, Inc., and *J. W. GALLOWAY*, Automatic Humidifier Co. The association will direct its activities towards research (in the methods and effects of adding controlled humidity to winter air); training (instruction to dealers on installation, etc.); and a consumer education program.

A new all-centrifugal chlorine condensing installation, at the Allied Chemical and Dye Corp. Solvay Process Division, has been announced by *CARRIER CORP.*, Syracuse. Four centrifugal refrigeration compressors arranged in two directly staged systems will be used. The company also will install the country's first large centrifugal ammonia compresser, to be used for process refrigeration at the Monsanto Chemical Co. plant, Nitro, W. Va. The five stage centrifugal compressor driven by a 600 hp motor will double the capacity of an existing reciprocating ammonia system.

A $3,500,000 electrical motor manufacturing plant will be started in Orange County, Calif., by *U. S. ELECTRICAL MOTORS, INC.*, Los Angeles. An 85 acre site, 30 miles from Los Angeles, is being purchased. Construction will include a 50,000 sq ft administration building, and 250,000 sq ft of covered manufacturing area.

THE HAJOCA CORP., Philadelphia, has been named a distributor of "Uskon" electrical radiant heating panels manufactured by *UNITED STATES RUBBER CO.* The corporation has 33 branches in nine states along the eastern seaboard, and is the first supplier to heating contractors to handle the product. It is offering franchised dealerships in Pennsylvania, New Jersey, Maryland, Virginia, Tennessee, Georgia, Florida, Delaware, and North Carolina.

The general offices of *MARLEY CO.* have been moved to 222 West Gregory Blvd., Kansas City, Mo., to make room for increased manufacturing facilities at the old location.

COLUMBIA UNIVERSITY has announced plans for a $22,150,000 engineering center program which will combine teaching, research and practice. Besides the engineering school proper, there will be an institute of advanced engineering science and a division of cooperative research in engineering, which will work with industry on problems having educational value.

For help with any control problem, talk to MINNEAPOLIS Honeywell

Consult your nationwide "Honeywell Staff"

In planning schools, factories, offices and other large buildings no doubt you often run into this problem:

What's the best way to get coordinated technical help with a multitude of control systems—for temperature, ventilation, air conditioning, refrigeration, industrial process?

The answer is simple:

Call your local Honeywell representative.

He can give you unbiased advice on equipment, because he has a complete line of controls—pneumatic, electric, electronic. And to help you meet special problems, he can bring in specialists from one of 91 Honeywell offices.

When you *standardize on Honeywell*, all control applications can be treated as one project. And you'll be designing an integrated system that can be serviced and adjusted simply by consulting one company. The Honeywell service organization—with its wide scope and flexibility—is positive assurance that your controls will perform efficiently for a lifetime.

So from now on, plan to standardize on Honeywell. And call in your local Honeywell representative often. He's the key man on your nationwide "Honeywell Staff."

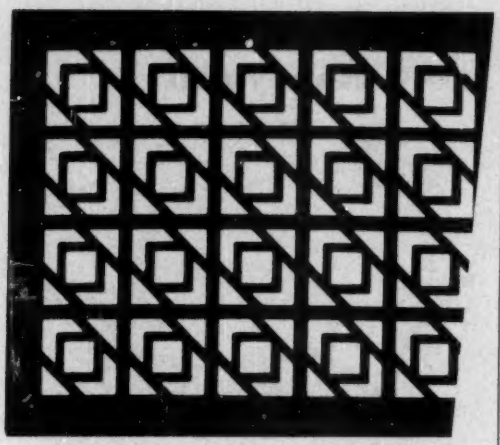
Send for your personalized cartoon

. . . and for help with the temperature control, we'll talk to (your firm name).

For your personalized, free 8½" x 9" reproduction of this Coheen cartoon, write to Honeywell, Dept. HA-12-208, Minneapolis 8, Minnesota.

MINNEAPOLIS Honeywell

First in Controls



Design M No. 7

There are many exclusive Hendrick Grille designs

The wide popularity of Hendrick Ornamental Metal Grilles is due not only to their mechanical perfection, but also because there is so wide a choice of pleasing designs from which to make a selection.

Many of the most attractive designs are obtainable only from Hendrick; a number of the most distinctive having been developed to meet an architect's specifications for use in some outstanding building and being covered by design patents.

With over a hundred designs from which to choose, a Hendrick grille design can readily be found that will harmonize with any particular decorative motif.

Write for detailed information.

1876—Seventy-Fifth Anniversary—1951

Perforated Metals
Perforated Metal Screens
Wedge-Slot Screens
Architectural Grilles
Mitco Open Steel Flooring,
Shur-Site Treads, Armorgrids

HENDRICK
Manufacturing Company
48 DUNDAFF STREET, CARBONDALE, PA.
Sales Offices in Principal Cities

HERBERT HOOVER was awarded the Howard Coonley Medal for services to the voluntary standards movement at the recent annual meeting luncheon of the *AMERICAN STANDARDS ASSOCIATION*. He was cited specifically for his work on national standardization projects as Secretary of Commerce, and for his emphasis on administrative standards in the Hoover Commission Report of 1949.

PITTSBURGH PLATE GLASS CO., Pittsburgh, will enter the fiber glass production field soon, and is now forming a separate *FIBER GLASS DIVISION*. It will be headed by *J. HERVEY SHERTS*, with the company since 1928, who will serve as general manager.

JOHN F. McKEE, Ardmore, Pa., has been awarded a Certificate of Merit by the *FRANKLIN INSTITUTE*, Philadelphia, for his development of the small, lightweight, impulse steam trap produced by the Yarnall-Waring Co., Philadelphia.

The engineering department of *KENCO, INC.*, Lorain, Ohio, has developed a test stand equipped for complete hydraulic as well as electrical testing of the company's utility and sump pumps. It will be distributed to all company service centers in the country.

More than 1000 people recently attended an "open house" celebrating the dedication of the new Duncansville, Pa., plant of *THE NATIONAL RADIATOR CO.*

ALBERT R. MUMFORD, research engineer for Combustion Engineering-Superheater, Inc., New York, recently received the Percy Nicholls' Award at the Joint Fuels Conference sponsored by the fuels division of the *AMERICAN SOCIETY OF MECHANICAL ENGINEERS* and the coal division of the *AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS*. The award is for achievement in the field of solid fuels.

Construction work will soon begin on the new *ALUMINUM CO. OF AMERICA* aluminum smelting plant at Rockdale (Milam County), Tex. *JOHN D. HARPER* has been named works manager. The production capacity will be approximately 170,000,000 lb annually.

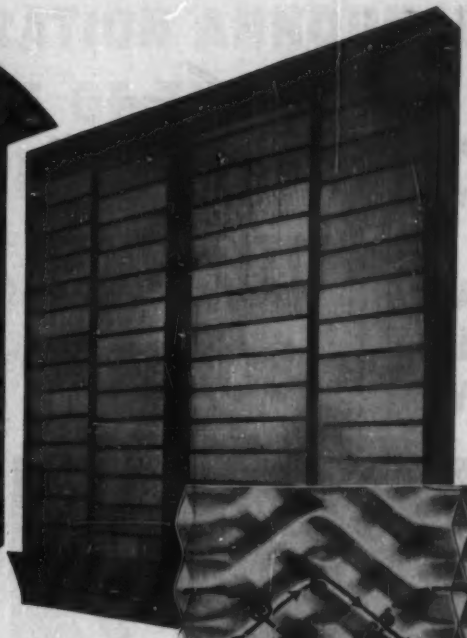
The construction firm of *BOOTH & FLINN CO.*, Pittsburgh, is distributing among customers a new brochure containing biographies and portraits of the 16 top superintendents and foremen. The firm recently was purchased by a group headed by *M. E. LIPSETT*, president.

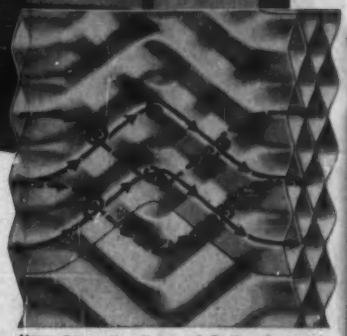
THE PENN VENTILATOR CO. recently filled a 24 hour emergency order from the Army Air Forces for specially built roof exhaust units to be installed at the Lake Charles, La., air base. A crew of mechanics worked throughout the night to fabricate the units.

CONOFLOW CORP., Philadelphia, has opened an auxiliary plant, close to the main office and factory, to accommodate the assembly and shipping division.

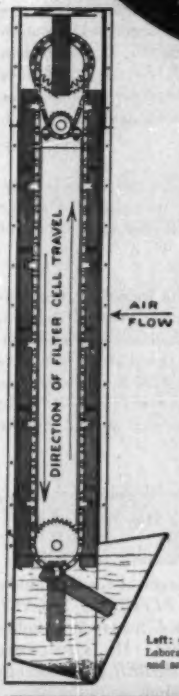
Construction is now proceeding on the new headquarters of the *SHEET METAL WORKERS UNION*, Local No. 73, which will be located at 3350 W. Jackson Blvd., Chicago.

Revolutionary CONTINENTAL AIR FILTERS *prove highly efficient in operation*





Above: Cross-section diagram of Continental patented filter media showing turbulent air flow, which results in extremely high air-cleaning efficiency (91.5% by A. S. H. V. E. method), and exceptionally low resistance.



Left: Cutaway view of Continental filter unit (listed by Underwriters' Laboratories, Inc.) showing filter cell Ferris Wheel rotating action and self-cleaning oil bath action.

In five short years Continental Automatic Self-Cleaning Air Filters installed in plants, factories, stores, offices and institutions, have confirmed the findings of independent tests by A.S.H.V.E. Code Methods. These tests . . . plus experience under actual operating conditions . . . prove that Continental Air Filters provide an exceptionally high cleaning efficiency. Perhaps the most convincing proof, however, is the fact that users, when they need additional filters, have again specified Continental.

NEW PATENTED FILTER MEDIA

In the revolutionary new filter media design, air passes through 720 honey-comb openings per square foot and is forced to criss-cross through many turbulent crossings in the large, smooth, *non-clogging* air passages. The result is (1) extremely high cleaning efficiency; (2) extremely low resistance; and (3) extremely suitable to automatic self-cleaning.

FERRIS WHEEL-ACTION

Non-reversing feature of the rotating curtain is an exclusive advantage of Continental Automatics. Ferris wheel-action of the filter cells as they pass from front to rear curtain prevents reversal of air flow thru the filter media . . . and eliminates the possibility of blowing dirt out of reversed media into clean-air stream.

AUTOMATIC SELF-CLEANING

With every rotation of the curtain, each filter cell passes through the oil reservoir, soaking for a time in a semi-horizontal position. Then it drops to a vertical position, causing the resultant surge of oil to pass through and effectively flush the dust from each air passage.

WRITE FOR PERFORMANCE DETAILS

Before you specify or buy, ask us for complete performance data on Continental Automatic Self-Cleaning Air Filters. Use this coupon. No obligation.

GENTLEMEN: Please send me following:

☐ Bulletin No. 201-C

☐ Sample of Rimrock Air Filter Media

NAME _____

FIRM _____

STREET _____

CITY _____ STATE _____

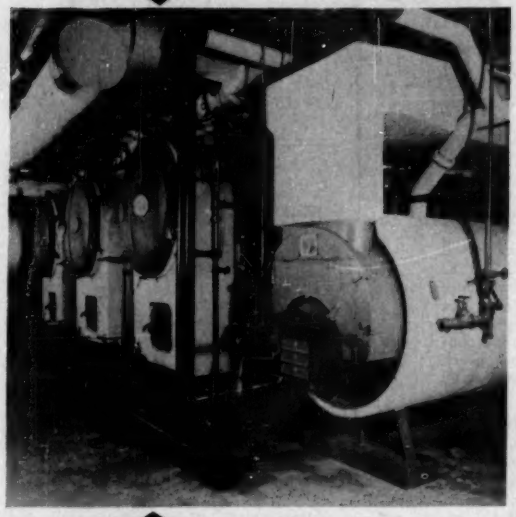
CONTINENTAL AIR FILTERS, Inc.

P. O. BOX 1647 • LOUISVILLE 1, KY.

For "Bedrock Economy" in HEATING and POWER

Choose and use

TITUSVILLE BOILERS



Compact, efficient layout distinguishes this Titusville boiler installation.

Here in the boiler room of the new Booker T. Washington High School in Shreveport, La., are shown three Titusville "Compact" Steel Heating Boilers (total rated capacity in excess of 36,000 sq. ft.), with a 30 H.P. Titusville "Wee Scot" marine boiler serving laundry and kitchen. The complete range of Titusville boilers enables many ideal service combinations. *Write us for details.*

THE TITUSVILLE IRON WORKS COMPANY

A division of Struthers Wells

Representatives in Principal Cities

TITUSVILLE, PENNSYLVANIA

WHO'S WHAT

S. CHARLES SEGAL, for the past 11 years the company's chief engineer, has been appointed general sales manager for *KRAMER TRENTON CO.*, Trenton. In his new post, he will also direct the activities of the advertising department.

C. A. DUNHAM CO., Chicago, has named *DONALD K. GEDMAN* acting defense contract officer. Formerly a representative in the contract office, he replaces *EDWARD F. FORD*, who has resigned. Mr. Ford is now with the Sales Division of *BELL & GOSSETT CO.*, Morton Grove, Ill.

WILLIAM BYNUM has been elected executive vice president of *CARRIER CORP.*, Syracuse. Formerly, he was vice president and general sales manager.

UNITED STATES AIR CONDITIONING CORP., Minneapolis, has reorganized its sales department into three separate divisions. The equipment division (heaters, unit air conditioners, etc.) is headed by *L. P. HANSON*, vice president and sales manager. The packaged refrigeration division is directed by *D. E. FEINBERG*, vice president and sales manager, and *R. D. McLAIN*, assistant sales manager. *WILLIAM MOISELLE* has been named sales manager of the gas division; he will be assisted by *A. J. ROCKLITZ*.

H. Y. BASSETT, vice president, Calumet & Hecla Consolidated Copper Co., and general manager, Wolverine Tube Div., has been elected to the board of directors of *ACME INDUSTRIES, INC.*, Jackson, Mich.

The new assistant manager, of the industrial relations division, *YORK CORP.*, York, Pa., is *C. FRED GIBBS*, formerly director of employee publications and community relations. *RICHARD C. NIESS*, until recently a sales engineer for the company's north Atlantic district, has been transferred to the home office where he will assist with engineering problems connected with special defense and civilian projects.

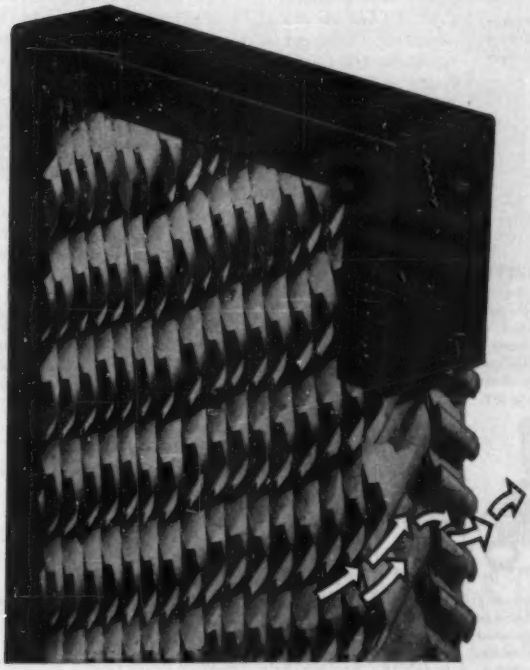
ROGER E. GAY, president, The Bristol Brass Corp., Bristol, Conn., has been elected president of the *AMERICAN STANDARDS ASSOCIATION*.

KARL H. MEYER, formerly manager of the Ashtabula, Ohio, plant of *THE RELIANCE ELECTRIC & ENGINEERING CO.*, has been appointed manager, Ivanhoe Div., with headquarters at Cleveland. He is succeeded in his former post by *WALTER H. HABER*, most recently superintendent of the Ashtabula division.

J. W. SPOOR, formerly manager, Product Service Div., *A. O. SMITH CORP.*, Milwaukee, has been named general sales manager, Welding Products Div. *L. F. VONIER*, former sales manager, has been appointed to the newly created post of sales promotion manager for the division. Succeeding Mr. Spoor in his former post is *CHARLES SMITH*, previously field service manager.

AIR-MAZE CORPORATION ANNOUNCES PURCHASE OF THE DETROIT AIR FILTER COMPANY

Production of Detroit's DUSTAY® disposable panels to be increased to meet growing demand



Cross-section of the Air-Maze Dustay filter panel showing how air changes direction twice, bringing dust particles in contact with the adhesive-coated cellular channels.

WITH THE ACQUISITION of The Detroit Air Filter Company, Air-Maze—which has previously manufactured only the *permanent* types of filter panels—now offers customers a choice of *disposable* filters as well, thus supplying every filter panel need.

Dustay® filter panels have had outstanding acceptance for warm air furnaces, air conditioning units and ventilating systems because they hold more dirt and last longer than other disposable types. And Air-Maze is stepping up production to meet the growing demand.

HOLD MORE DIRT—LAST LONGER

Dustay filters hold more dirt—and last longer—because: (1) they hold more adhesive—over a pound compared to only 3 to 6 ounces for most competitive makes, and (2) their cellular passages permit "depth" of dirt-holding capacity, where other disposable panels rely on surface loading.

The large amount of adhesive stored within the highly-absorbent filter cores makes possible Dustay's remarkable "wick action". As dust adheres to the collecting surfaces it absorbs the adhesive through capillary attraction. The adhesive-laden dust then becomes a medium to collect succeeding particles.

CHANGES AIR FLOW TWICE

Air changes its direction of flow upon entering the Dustay filter, then is forced to take a different direction half way through. This creates a scrubbing action which assures thoroughly cleansed air at the outlet.

Air-Maze Dustay filters provide low-cost clean air for both home and industry—in warm air furnaces, air conditioning units and ventilating systems. For full details call your nearby Air-Maze representative or write Air-Maze Corp., Cleveland 5, Ohio.

AIR FILTERS
SILENCERS
SPARK ARRESTERS

AIR-MAZE

THE FILTER ENGINEERS

LIQUID FILTERS
OIL SEPARATORS
GREASE FILTERS

Alnor OFFERS YOU FOUR WAYS TO Save Time ...Save Money!

Time spent in needless rechecking, balancing and adjusting of heating and air conditioning systems is a waste. It can easily account for much of the cost on every installation and service job.

Here are four Alnor precision instruments that help you do a better job—faster, at lower cost. And like all Alnor instruments—in every industry—the ones shown here are favorites wherever precision and fine craftmanship are essential.

ALNOR VELOMETER ... is a precision-built, self-contained, portable instrument that gives instant, accurate readings of air velocities anywhere. Needs no calculations or reference charts ... is direct reading. Available in wide scale range. *Write for Bulletin No. 2448-G.*

ALNOR THERMO-ANEMOMETER ... is a compact, simple instrument for reading air velocities as low as 5 f.p.m. It makes possible fast adjustment of velocities to bring utmost comfort ... efficiency. Drafts within rooms, flow from convectors, air flow in refrigerated spaces—all these and many more are ideal uses for this handy, direct reading precision instrument. *Send for Bulletin 913.*

ALNOR TYPE 2300 SURFACE PYROMETER ... sets a new high in precision measurement of low surface temperatures. Special design from Alnico magnet to finest, quick reacting thermocouple assures unfailing accuracy ... speed and dependability. Available in 5 Fahrenheit scale ranges with a span as small as 150°. *Send for Bulletin.*

ALNOR VELOMETER JR. ... ideal for taking a quick, accurate check on circulation and diffusion of air. Sturdily built, carefully calibrated, the palm-sized Velometer Jr. gives instant reading of air velocities without timing, reference charts, etc. *Send for Bulletin No. 725.*

Alnor PRECISION INSTRUMENTS FOR EVERY INDUSTRY

Illinois Testing Laboratories, Inc.
Room 513, 420 N. La Salle Street, Chicago 10, Ill.

Send complete information on the following:

☐ Velometer ☐ Thermo-Anemometer
☐ Type 2300 ☐ Velometer Jr.

Name.....

Address.....

City.....**Zone**.....**State**.....

G. J. CHRISTNER of The Eagle-Picher Sales Co., Cincinnati, has been elected president and chairman of the board, *INDUSTRIAL MINERAL WOOL INSTITUTE.* During the past year he has been vice president and a director of the institute.

ANTHONY G. MASIELLO, formerly with Carrier Corp., is now assistant to the general sales manager, Remington Air Conditioning Div., *REMINGTON CORP.,* Auburn, N. J. *C. KENNETH JUNO,* formerly with Columbian Rope Co., is the new advertising manager for the division.

ROBERT W. PILLSBURY has been appointed superintendent, Sheet Metal Div., *BURDETT MFG. CO.,* Chicago. His past positions include that of superintendent, United Steel Fabricators and the Newcomb Detroit-Grand Rapids, Michigan division.

The new president (1951-52 term) of *THE AMERICAN WELDING SOCIETY* is *CHARLES H. JENNINGS,* engineering manager of the welding department, Westinghouse Electric Corp. *ROBERT S. GREEN,* associate professor and chairman, department of welding engineering, Ohio State University, has been elected a director of the society. He is currently consultant to the National Certified Pipe Welding Bureau, and is the AWS sustaining member representative of that organization. *ALEXCI P. MARADUDIN,* metallurgist and materials engineer, Standard Oil Co. of California, has been elected society vice president, and *ERIC R. SEABLOOM,* supervisor of field engineering, Crane Co., is the new second vice president.

The society's Samuel Wylie Miller Memorial Medal, for conspicuous contributions to the advancement of welding, was awarded for 1951 to *CASIN W. OBERT,* engineering consultant for Linde Air Products Co., a division of Union Carbide and Carbon Corp.

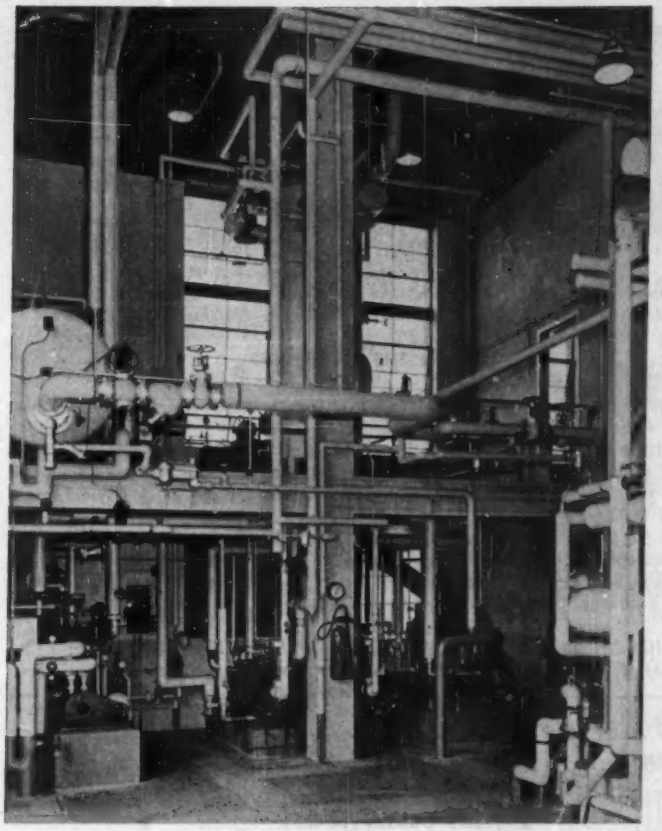
ANSUL CHEMICAL CO., Marinette, Wis., has appointed *RICHARD A. LINE* as chief engineer, Refrigeration Div. Formerly, he held a similar post with the Lehigh Mfg. Co.

GEORGE A. FRICKE, formerly with the Griscom-Russell Co., has joined *SUPERIOR COMBUSTION INDUSTRIES, INC.,* New York, as manager, Heat Exchanger Div.

JAMES F. THOMAS has been named plant manager of the new Duncansville, Pa., sheet metal fabrication plant of *THE NATIONAL RADIATOR CO.* Previously, he was manager of the company's Century plant, which was destroyed by fire in October 1951.

WILLIAM H. SISSON has been named power industry manager for *MINNEAPOLIS-HONEYWELL REGULATOR CO.,* with headquarters in Philadelphia. He will promote sales in the central station and power fields. *GEORGE M. ROSSITER* succeeds him in his former post as industrial manager of the Indianapolis office.

W. B. CONNOR ENGINEERING CORP., Danbury, Conn., has appointed *ISHIER JACOBSON* as general



Power house, Middlesex General Hospital, New Brunswick, N. J. Insulation is "Featherweight" 85% Magnesia.
Plumbing & Heating Contractor: Richardson Engineering Co., New Brunswick.
Architect: Alexander Merchant & Son, New Brunswick, N. J.
Engineers: Runyon & Carey, Newark, N. J.

Nature made Asbestos . . .
Keasbey & Mattison has made it serve mankind since 1873.

KEASBEY & MATTISON
COMPANY · AMBLER · PENNSYLVANIA

RANGES OF KEASBEY & MATTISON LOW PRESSURE INSULATIONS

INSULATION	50°F	100°F	200°F	300°F	400°F	500°F	600°F
DUPLEX							
AIR CELL							
FINE CORRUGATED AIR CELL							
SPECIAL FINE CORRUGATED AIR CELL							
SIMPLEX "SUPER SHRUNK"							
"FEATHERWEIGHT" 85% MAGNESIA							

Most efficient and practical insulation up to 600°F.—

"FEATHERWEIGHT"® 85% MAGNESIA

HIGHLY efficient . . . completely practical . . . easy to apply—no wonder 85% Magnesia is the most widely used insulation in its field today!

Here are facts about "Featherweight" 85% Magnesia—facts that are reasons why this is such a popular and practical insulation:

DELIVERS HEAT WHEN AND WHERE IT'S WANTED! "Featherweight" 85% Magnesia withstands temperatures up to 600° F. without loss of insulating value. Alternate heating and cooling, wetting and drying do not affect its insulating properties.

STRUCTURALLY STRONG—PERMANENTLY EFFICIENT! "Featherweight" insulation, though light in weight, is strong. It can withstand intermittent or continuous vibration; reasonable amounts of compression.

EASY TO HANDLE — EASY TO APPLY! "Featherweight" can be shipped, stored, and handled without any special precautions. It fits snugly to contours without breaking; is easily sawed or cut; can be applied with a minimum number of tools.

SUPPLIED FOR ALL NEEDS: In block form for flat, curved, and irregular surfaces; in sections and sets of segments for standard pipe sizes.

Keasbey & Mattison "Featherweight" 85% Magnesia is one of the complete line of K&M Insulations. Ask your K&M Distributor for complete information; or, write us direct.

counsel. He is a graduate of the Harvard Law School, and of the Harvard Graduate School of Mechanical Engineering.

F. GUY RUTAN, secretary of *WIGTON-ABBOTT CORP.*, engineers and contractors, Plainfield, N. J., has been named executive vice president, a newly created post. He joined the company in 1941.

ROBERT L. FARMER, with the company since 1943, has been appointed factory sales engineer for *GENERAL CONTROLS CO.*, Glendale, Calif. . . . . *HAROLD P. GLAVIN* has been named general manager, of the midwest division factory for *TURCO PRODUCTS, INC.*, Los Angeles.

FRANK P. REGAN has been named divisional president of *TRIMONT MFG. CO.*, Roxbury, Mass., division of Aetna Industrial Corp. He succeeds *A. E. KEATING* who has resigned. Mr. Regan will continue in his post of general sales manager.

DR. DEANE W. MALOTT, president of Cornell University, has been elected to the board of *OWENS-CORNING FIBERGLAS CORP.*, Toledo. He succeeds *GEORGE KEITH FUNSTON*, who recently resigned when he became president of the New York Stock Exchange.

WORTHINGTON PUMP AND MACHINERY CORP., Harrison, N. J., has appointed *THOMAS F. GRIFFIN*, with the company for ten years, as Holyoke Works purchasing agent. He succeeds *MILTON ROBERTS*, who has resigned.

THE LAMSON CORP., Syracuse, has appointed *ORRIN R. BROBERG* as mechanical development engineer. . . . . *FREDERIC B. POWERS* has been made president of *THE RAWLPLUG CO., INC.*, New York, succeeding the late *WINTHROP R. HOWARD*.

MITCHELL MFG. CO., Chicago, has established separate divisions to be responsible for its various manufacturing activities. In charge of the air conditioning division is *E. A. TRACEY*, company vice president.

. . . IN THE TERRITORIES

For *WELSBACH CORP., KITSON DIV.*, Philadelphia —*H. EMORY PEDDICORD*, 6302 Pinehurst Rd., Baltimore, will cover heating wholesalers in the District of Columbia, and in Arlington and Rosslyn in Virginia, as well as those in his present territory.

For *VIKING AIR CONDITIONING CORP.*, Cleveland —*JOHN C. CARMAN* is the new representative in Michigan, northern Indiana and northwestern Ohio. He has been with Detroit Heating Co., since 1936.

For *BABCOCK & WILCOX TUBE CO.*, Beaver Falls, Pa.,—a new assistant sales manager for the Houston office,

Darling it's so exciting . . .

I just can't wait

to see those sensational, new

STANDFORATED

Perimeter Baseboard Registers

WITH SLIDING DAMPER CONTROL

Write Now for Your Free Copy of Standard's Amazing New Pocket Catalog

- Used in homes, schools, churches and commercial installations.
- Comes in four foot sections.
- Simplifies balancing of heating systems.
- Fabricated of 20 gauge steel.
- Finished with Prime Coat only—special finishes on request.

Standard Stamping & Perforating Co.

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Attach this to your business letterhead and mail for new catalog.

The Greatest Show on Earth!

for the entire oil heating industry . . .

29th ANNIVERSARY OIL-HEAT EXPOSITION

April 14 through 18, 1952 • Commercial Museum • Philadelphia, Pa.

Two big shows rolled into one. Always the "hit parade" of industry products, the 29th Anniversary Oil-Heat Exposition will be the biggest ever! No show in '53 because exhibitors have asked for one really *big* show every two years. So this is it! Two big shows rolled into one at Philadelphia's popular Commercial Museum!

FLOOR PLANS ARE READY! Choice space is available on a first-come-first-served basis. 7,000 equipment and fuel oil dealers plus 25,000 consumers will be there—each and every one a prospect for *your* equipment! Protect your share of an oil heating market that has grown 12½% every year since World War II by ordering your space now! If your floor plan has not arrived, advise us at once. It'll be sent by return mail!

PHONE • WRITE • WIRE for your floor plans to:

The Oil-Heat Institute of America, Inc.
6 E. 39th Street, New York 16, N. Y.
Murray Hill 5-1638

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KINETIC* BURNER

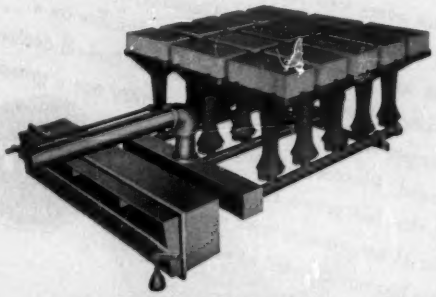
For Low Pressure Gas

The Webster Kinetic consists of a multiplicity of full venturi mixers with flame retention nozzles. These are assembled in a metal casing complete with pilot and louvre. It may be used with natural, mixed or liquefied petroleum gases. Standby oil burners may be used when desired. As a multiple head assembly it is available in 25 standard sizes of from 4 heads to 48 heads, and can be supplied in any size or shape. Natural gas input ratings from 560,000 Btu/hr to 6,720,000 Btu/hr at 4" wc.

For complete information request Series B8 Bulletins.

WEBSTER
SERIES F 600 BURNER

For Low Pressure Gas



Designed for LOW GAS PRESSURE
INTERCHANGEABLE PORTS
RADIANT fire brick top
NO COMBUSTION CHAMBER required
Will NOT VIBRATE
LOW draft loss
ANY SHAPE and SIZE
INTEGRALLY MOUNTED pilots

*TRADEMARK

The WEBSTER ENGINEERING COMPANY
TULSA, OKLAHOMA
Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

J. H. ROACH, formerly located at the Tulsa office. *W. C. MOHRMAN*, formerly at the Houston office, was transferred to Tulsa and named a district salesman.

For *AFFILIATED GAS EQUIPMENT, INC., DAY AND NIGHT DIV.*—three new sales appointments. *FRANK SPRATT*, who has represented the division in the midwest, is now southern California sales manager for the company. *JIM BUSTER* has been assigned as sales representative for the division in the midwest territory, with headquarters in Tulsa, and *JOHN LYONS* is the new representative in the Pacific northwest territory.

For *ECLIPSE FUEL ENGINEERING CO.*, Rockford, Ill.—*M. K. GRIGGS CO.*, 2801 San Jacinto, Houston, is now representative for the Houston area.

For *TURCO PRODUCTS, INC.*, Los Angeles—a new midwest sales manager, *ARCHIE K. BEARD*, formerly district manager in Cleveland. He will make his headquarters in Chicago.

For *SERVEL, INC.*, Evansville, Ind.—*GORDON J. MALONE*, with the company for 13 years, is now eastern regional manager for air conditioners, refrigerators and water heaters. Headquarters are in New York. He succeeds *GEORGE R. COPELAND*, who recently resigned to become vice president of the Algonquin Transmission Co., Boston. Succeeding Mr. Malone as Philadelphia district sales manager is *RAY J. PASK*, who has been manager of the Detroit sales branch.

For *CARRIER CORP.*, Syracuse—*THE CANNON DISTRIBUTING CO.*, Charleston, has been named distributor in the South Carolina territory, for room air conditioners and dehumidification units.

For *GENERAL CONTROLS CO.*, Glendale, Calif.—*FELIX WENGERTER* has been appointed district manager of the New York branch office, and will have charge of all New York and Newark branch office territory activities.

For *BUSH MFG. CO.*, West Hartford, Conn.—three new appointments to the Chicago office, including *CLARK BRIDGMAN* and *HARRY BARGEMAN*, formerly with the Clark Bridgman Co., and *BEN PRATHER*, a new application engineer.

For *TINNERMAN PRODUCTS, INC.*, Cleveland—*CHARLES R. LUND* is a new sales engineer in the Los Angeles district office. Most recently he has been a salesman with Air Associates, Inc.

For *YORK CORP.*, York, Pa.—*JOHN H. HARRISON* is a new sales supervisor in the southwest district. He had been associated with Wells Mfg. Corp. in a similar capacity.

For *DRAVO CORP., HEATING DEPT.*, Pittsburgh—a new southern sales and service manager, *WILLIAM W. TIMMIS, JR.*, with headquarters at 800 Peachtree St., N.E., Atlanta.

For *UNISTRUT PRODUCTS CO.*, Chicago—a new southwestern district sales office and warehouse at 1321 Spring St., N. W., Atlanta. *BRAD FOGARTY*, formerly with Sylvania Electric Products, has been named district manager. In the west coast region, *DUNCAN A. BROWNLEE* is the new sales and service contact. Formerly he was associated with Reynolds Metals Co.

For *SPRINGFIELD BOILER CO.*, Springfield, Ill.—*A. D. FLOWER* has become a member of the Philadelphia sales staff, and will cover the eastern half of Pennsylvania, southern New Jersey, the District of Columbia, and the states of Delaware, Maryland and Virginia. *DELMER ENGINEERS*, 902 E. Third St., Los Angeles, has been appointed representative in lower California, in Arizona, and in part of Nevada.

For *THE MARLEY CO., INC.*, Kansas City, Mo.—a new Washington, D. C. engineering service office in the Wyatt Building, 777 14th St., N.W. *DON COUSINS* has been named manager.

For *L. J. WING MFG. CO.*, Linden, N.J.—*THE STONE CO.*, Rochester, N.Y., has been appointed to handle the complete line of products in western New York, including the Rochester area.

For *WESTERN ENGINEERING AND MANUFACTURING CO.*, Los Angeles—*ANDERSON BROTHERS ENGINEERING CO.*, 3409 Martin Ave., Omaha, has been appointed representative for Nebraska and the western counties of Iowa.

For *C. A. DUNHAM CO.*, Chicago—a new sales engineer for the Tennessee area, *JOHN M. DOOLEY*, with offices at 4036 Sequoyah Ave., Knoxville. He replaces *GARRET PARKER*, who was recalled to the Navy.

For *TAYLOR FORGE & PIPE WORKS*, Chicago—*GALE CARROLL* has been added to the Houston district sales office. Most recently he served as sales and advertising manager for Tube-Kote, Inc.

For *HAMMOND BRASS WORKS*, Hammond—a new representative for New England, *T. G. COLTER*, with headquarters at 250 Stuart St., Boston. He will continue to handle products of the Dole Valve Co., which he has represented for 26 years.

For *THE SWARTWOUT CO.*, Cleveland—a new sales and service office in Houston (in the M and M Building), to serve the entire state. Both the steam specialties and the roof ventilator divisions will share the space. *WILLIAM A. SHARP* will head the ventilator service, and *J. B. DOWNEY*, steam specialties. *HOWARD T. RIELEY*, who has represented both divisions for many years, will continue in this territory, operating from the company offices.

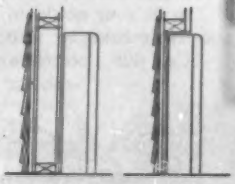
For *WOLVERINE TUBE DIV., CALUMET & HECLA CONSOLIDATED COPPER CO.*, Detroit—*E. J. CAMPBELL* is the new midwestern district sales manager, with headquarters in Chicago. Since 1948 he has been the district's assistant sales manager.

AIRTHERM
Convectors
Designed for Quick, Easy, Time-Saving Installation

Attractive appearance, outstanding performance and ease of installation have led to an increasing preference for Airtherm Convectors in institutions, apartments, homes and schools.
Try AIRTHERM on your next job.
An Airtherm Heating Installation is your assurance of a satisfied customer.

Airtherm Convectors are available for either free standing or recessed installation.

Write for Catalog 702A for additional information.



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For Heating Satisfaction . . . Think First of AIRTHERM

AIRTHERM MANUFACTURING COMPANY
711 South Spring Avenue • St. Louis 10, Missouri

Speed up Assembly!

Switch to BLACK & DECKER POWER!

BLACK & DECKER HOLGUN* drills holes to ¼" diam. in steel, to ½" diam. in hardwood. Perfectly balanced, light in weight, compact, easy to handle, accurate. Famous "Pistol Grip and Trigger Switch."

BLACK & DECKER SCRUGUN* drives machine screws and nuts to ¼", self-tapping screws to #12, wood screws to #10 x 2". Positive or adjustable clutch available. Same design features as B&D HOLGUN!

SEE YOUR NEARBY B&D DISTRIBUTOR for demonstrations and full details on this famous team of assembly tools. They'll help your men turn out more work, with less fatigue and less spoilage. And you have nearly 50 other B&D Drill and Screw Driver models to choose from to fit your needs on heavier work! Write for free catalog to: THE BLACK & DECKER MFG. Co., 628 Pennsylvania Ave., Towson 4, Md.

*Trade Mark Reg. U. S. Pat. Off.

SHEARS SANDERS BENCH GRINDERS HAMMERS

LEADING DISTRIBUTORS EVERYWHERE SELL

Black & Decker PORTABLE ELECTRIC TOOLS

NEW BOOKS & REPORTS

ASRE Basic Refrigeration Data Book

The Refrigerating Data Book — Basic Volume (7th edition), published by the American Society of Refrigerating Engineers, includes information on the fundamentals of refrigeration design, theory, thermodynamics, refrigerant properties, and related topics. The society publishes two refrigeration data books on alternate years, one treating fundamentals (the present volume), and the other, practical applications.

The section on air conditioning discusses theory (properties of moist air, air purification, etc.), fans and ducts (fan selection, design of duct systems, etc.), air conditioning calculations, air systems, small comfort cooling systems and units, and various types of control systems. In the components section, there is a chapter on pipe and piping, covering size, materials, strength, method of assembly, expansion and contraction, and protection against damage.

Other sections cover theory (psychrometry, heat transmission, etc.), tables (refrigerant tables and charts, conversion tables, psychrometric tables, etc.), industrial systems (evaporative condensers, low temperature systems, etc.), and domestic and commercial systems (commercial low sides and refrigerators, etc.)

Also included is a 215 page classified listing (with manufacturers) of equipment and accessories used in the refrigeration industry.

This 679 page book (exclusive of the listing) is available from the society, 40 W. 40th St., New York, at $7.50 a copy in the U.S., $8.00 elsewhere.

Design, Construction and Application of Overfire Jets for Smoke Prevention

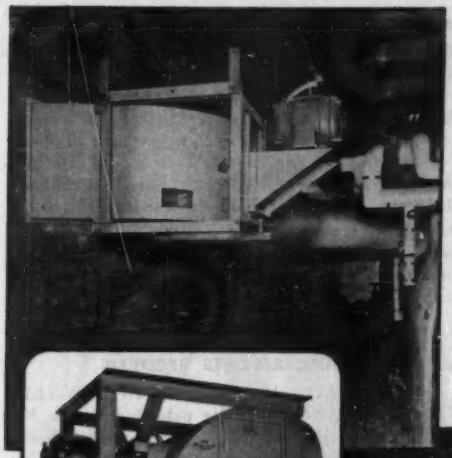
Basic principles for the design, construction and application of overfire jets that supply to both hand fired and stoker fired furnaces for smoke prevention are treated in the pamphlet, *Application of Overfire Jets to Prevent Smoke from Stationary Plants*, published by Bituminous Coal Research, Inc. This is the first pamphlet, No. 500-300, in a new *BCR Aids to Industry* series, and it is a revision of BCR's technical report VII, which has gone through three previous editions.

Separate sections cover design and construction of blower jets and of steam-air jets and silencers, construction of plain steam jets, location of jets, typical jet installations, and control and care of overfire jets. In the design sections, information is given on how to determine such factors as size of air tube for introducing the air, how far apart the tubes should be, where they should be placed in the furnace wall, etc. A list of manufacturers of overfire jets, photoelectric cell smoke alarms, and control equipment is included.

This 24 page pamphlet is available from the publisher, 2609 First National Bank Bldg., Pittsburgh 22, at 50 cents a copy (40 percent discount for BCR members).

Piping Stress Calculations

Calculation of pipe stress under changing temperature conditions usually requires extensive background and working knowledge of calculus. In *Piping Stress Calculations Simplified* (4th edition), by S. W. Spielvogel, me-



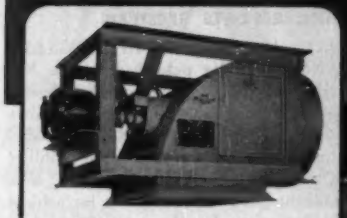
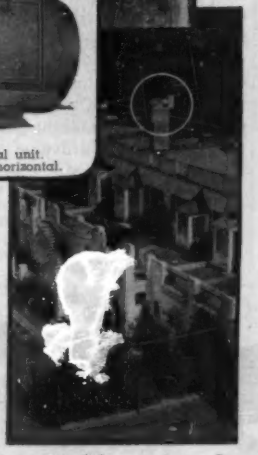


Illustration shows vertical unit. Installation above shows horizontal.



Does "Draft" Mean "Tall Chimney" to You?

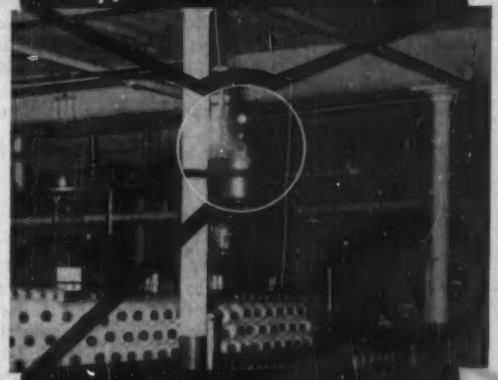
If it does, you will be agreeably surprised to see what a Wing Draft Inducer can do in furnishing positive uniform adequate draft without the need for tall, unsightly, expensive stacks. Unlike variable chimney draft, the Wing Draft Inducer permits operation at high efficiencies in any weather. It cuts fuel costs giving higher CO_2's. Smoking is greatly reduced or completely eliminated. The capacity of your heating plant is increased. Write for bulletin I-51.

Wing

DRAFT INDUCER

L. J. Wing Mfg. Co.
140 Vreeland Mill Rd.
Linden, N.J.
Offices in Principal Cities of U.S. & Can.

Question: What about Unit Type Steam Humidifiers?



Answer: Armstrong Unit Type Steam Humidifiers are ideal for overcoming wintertime dry air conditions for the following reasons:

- **Fully Automatic.**
- **Accurate Control**—within 1%—2% relative humidity
- **Clean**—no residue in the air
- **Quiet**—acoustically designed
- **No cooling effect**—raise room temperature a degree or two
- **Economical to operate**—pennies per day per unit—⅓ to ¼ the price of water spray equipment
- **Low in first cost** approximately $182 complete for a unit to handle up to 40,000 cu. ft.
- **Easy to install anywhere**—hooked up to existing steam and electrical systems much like unit heaters
- **Dependable**—quality materials and workmanship
- **Guaranteed**—complete satisfaction or your money back. Write today.

ARMSTRONG MACHINE WORKS
874 Maple Street, Three Rivers, Mich.

For Full Details Send for **BULLETIN 1773**

Operating principles, capacities, sizes, prices, hookups, selection data and other useful information — all included in Bulletin 1773. Send for your copy today.

ARMSTRONG *Steam* HUMIDIFIERS

BUILT BY THE MAKERS OF ARMSTRONG STEAM TRAPS

chanical engineering department, Consolidated Edison Co. of New York, exact solutions have been worked out in arithmetical form so that the practical pipe designer can refer to typical problems for both the form and method of computation.

This edition, published by the author, differs from the three preceding ones (McGraw Hill) by the addition of 21 tables for fast solution of one, two and three dimensional common shapes. It also contains methods for calculating deflections, and a simplified procedure for tabulating calculations. Chapters cover such topics as determining pipe wall thickness, allowable combined stress, single plane piping, thrust line, etc.

This 114 page book is available from the author, 15 Old Field Lane, Lake Success, N.Y., at $4.50 a copy.

Earth Heat Pump Operating on Cooling Cycle

Performance of an Earth Heat Pump Operating Intermittently on the Cooling Cycle, by E. B. Penrod and R. C. Thornton, department of mechanical engineering, University of Kentucky, is a paper describing tests covering the discharge of heat to the earth during the months of July, August and September, 1950. The research indicated that the earth is a suitable sink, as well as a suitable heat source, and it provides data relevant to the designing of earth heat pumps.

This 17 page paper is a reprint from the Transactions of the Kentucky Academy of Science, Vol. 13, No. 3, August, 1951.

Oxyacetylene Welding

Pipefitter Welder's Review of Oxyacetylene Welding for Qualification under ASME Code Rules, by Robert S. Green, is designed to assist pipefitter welders required to take qualification tests under the ASME boiler code.

It covers such topics as material, preparation of stock, spacing and tacking, control of the flame, tip size and gas pressures, practice welds, horizontal and vertical fixed positions, etc. Line drawings illustrate the various procedures.

The 40 page pamphlet is available from the publisher, National Certified Pipe Welding Bureau, Suite 1401, 1250 Avenue of the Americas, New York 20, for 50 cents a copy.

OTHER BOOKS AND REPORTS RECEIVED

LOCATING WARM AIR OUTLETS IN NON-RESIDENTIAL BUILDINGS, a folder published by the National Warm Air Heating & Air Conditioning Association, answers a typical question (a composite of a number submitted) on this subject. In the hypothetical plan discussed, the trunk line supplying heat to a store building must run along the ceiling in the center of the room. The advantages and disadvantages of various plans for achieving even heat distribution under these conditions are discussed.

The folder, which is Vol. 1, No. 3 of the *Questions & Answers* series, may be obtained from the association, 145 Public Square, Cleveland 14.

PENN
DYNAFANS
GIVE VENTILATION PROBLEMS
THE AIR...
No doubt about it—Penn Dynafans increase employee efficiency in your customer's plants by exhausting the "hot spots." This rugged unit can be depended upon to handle the toughest ventilation problems . . .
● Motors out of the air stream, safely remove dust, heat, fumes, vapors, etc.
● Economical to install and operate.
● Sizes range from 250 c.f.m. to 30,000 c.f.m.
● Pulling power is positive and units will not overload regardless of resistance.
● Units are quiet running and have a low clean silhouette.
Write for complete literature today.
Representatives and Distributors in Principal Cities.
PENN VENTILATOR CO.
PHILADELPHIA 40, PENNSYLVANIA
FOR MORE THAN 25 YEARS THE BUILDERS' ROOF TOP LINE!

Look here *first* when specifying expansion joints

Just "flexing" is not enough . . . it's Directed-Flexing Self-Equalizing — an exclusive Badger Mfg. Co. feature — that makes the real difference in expansion joint performance. The enlarged cross-section above shows the corrugated member in the unique *all-curve* pattern . . . no sharp bends or structure-weakening stresses . . . no danger of premature breakdown.

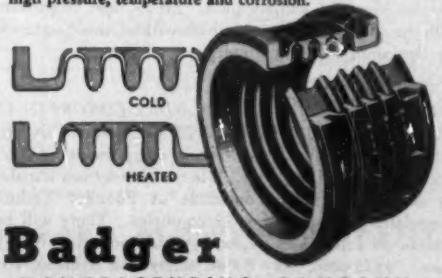
When combined with the correspondingly shaped Badger Self-Equalizing ring, a progressively controlled movement of each corrugation guarantees a more flexible longer lasting joint — a joint that succeeds where others fail. Get detailed information on the Badger Expansion Joint by writing today. Specify Badger Expansion Joints for every job.

Only Badger Expansion Joints have Directed-Flexing Self-Equalizing rings which progressively control the movement of the all-curve corrugations.

Plus 5 other big features

- Packless . . . pressure-tight single tube — requires no maintenance
- Compact . . . approximately the size of flanged fitting
- Special forming . . . no structure-weakening stresses
- Controlled heat treating . . . assures long life
- Wide range of traverse — pressure — temperature

Fabricated from deoxidized copper for normal pressures and temperatures, stainless steel alloys to withstand high pressure, temperature and corrosion.



Badger

MANUFACTURING COMPANY

230 BENT STREET, CAMBRIDGE, MASS.

NEW CONDENSATE RETURN UNIT

SENSATIONAL

ROTH
"Small vertical unit"
"2 sizes cover range up to 8000 sq. ft. EDR at 20 psi"
"Wide application!!!"
"Single phase or 3-phase 1750 RPM motor"
"10 or 15 gal. cast iron receiver (available in steel, too!)"
"Submerged pump handles liquid at 210°F —without vapor lock"
"Handy where piping is close to floor level"
"May be installed in shallow pit— needs minimum floor space!"

ALL THIS AT UNBELIEVABLY LOW PRICES!!!

● How can Roth make such a high quality vertical condensate return unit at astonishingly low prices? Roth has geared its manufacturing facilities and experience in mass production of pumps to produce top quality units at a price you can't afford to miss. *Roth Pumps* are made to tolerance of one-thousandth of an inch. Only the finest quality materials are used. Stainless steel shaft, bronze impeller and side plates. Every pump is individually tested. Construction meets the most exacting requirements. Motors and switches are the finest. See your nearest distributor or write direct today. Ask for Bulletin No. 212.

ROTH PUMPS

ROY E. ROTH COMPANY ● 2430-L 24th AVENUE, ROCK ISLAND, ILL.

A NEW KIND OF COMPACT STEAM POWER

NEVER BEFORE has such amazing *power* been built into such a *compact, efficient* boiler unit! The magic midget Scotch-mund is "power-packed" to deliver faster steam at constant pressure. It's a new, exciting experience for industrial users of steam power. Small, compact...fits almost anywhere. Easily and quickly installed. Either gas or oil fired. A.S.M.E. approved and fully *guaranteed* by MUND...the most dependable name in modern boilers.

Write for complete details

...More power and larger capacities (5-350 H.P.) with **MUND** *inclined water tube boilers.*

MUND BOILERS, INC.
1600 N. Indiana St., Los Angeles 63, Calif.

MEETINGS & CONVENTIONS

IBR SCHOOL OF MODERN HEATING—December 11 to 13, Hamilton Fire Co., 1805 E. State St., Trenton, N. J.; January 8 to 10, Bridgeport, Conn.; January 15 to 17, Boston Consolidated Gas Co. Bldg., Boston. Sponsored by The Institute of Boiler and Radiator Manufacturers, 60 E. 42nd St., New York 17. The school is a three day course providing instruction in the design and installation of hot water and steam heating systems. A complete list of meetings scheduled through June is available from the institute.

PLANT MAINTENANCE CONFERENCE AND SHOW—January 14 to 17, Convention Hall, Philadelphia. Registration and hotel information available from Clapp & Poliak, Inc., 341 Madison Ave., New York, exposition management. Exhibitors' list available from Banner & Greif, 250 W. 57th St., New York 19. The conference, which is sponsored by the American Society of Mechanical Engineers and the Society for the Advancement of Management, will stress preventive maintenance for defense production. It will be divided into more than 30 separate sessions to accommodate special talks on individual industry needs.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, 62 Worth St., New York—58th annual meeting, January 28 to 30, St. Louis. Next International Heating, Ventilating and Air Conditioning Exposition to be held in conjunction with the society's 59th annual meeting, January, 1953, Chicago.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS, 919 Milam Bldg., Houston, Tex.—1952 annual conference, March 10 to 14, Galveston.

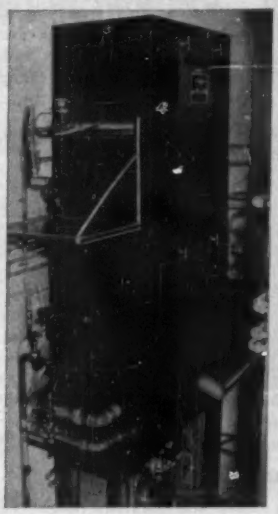
CHICAGO INTERNATIONAL TRADE FAIR—March 22 to April 6, Navy Pier, Chicago. Official agency handling the fair, Bozell & Jacobs, 326 W. Madison St., Chicago.

OIL-HEAT INSTITUTE OF AMERICA, INC., 6 E. 39th St., New York 16—29th anniversary exhibition of the automatic oil-heat industry, April 14 to 18, Commercial Museum, Philadelphia. To be held concurrently with the annual convention, which will be headquartered at the Benjamin Franklin Hotel.

1952 INTERNATIONAL FOUNDRY CONGRESS AND SHOW—May 1 to 7, Convention Hall, Atlantic City. Host this year, the American Foundrymen's Society, 616 S. Michigan Ave., Chicago 5. The congresses are scheduled by the International Committee of Foundry Technical Associations, representing 12 countries. There will be a session on safety and hygiene and air pollution (non-ferrous), 4:00 p.m., May 3; on safety and hygiene, 10:00 a.m., May 5; and on safety and hygiene and air pollution (ferrous), 2:00 p.m., May 5.

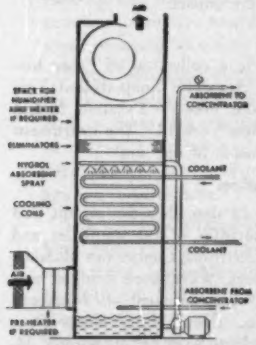
New "Controlled Humidity" Method Gives a Better Solution to Air Conditioning Problems

"Hygrol"
Absorbent
Liquid
Dehumidifies
Fresh Air
Without
Refrigeration



● NIAGARA Air Conditioners or Dehumidifiers using "Hygrol" liquid absorbent give precise control of air temperature and humidity . . . at lower operating cost, with large savings in space and with smaller and less expensive equipment, in many applications.

This method dehumidifies the air by passing it through a chamber in which "Hygrol" spray removes its moisture and produces a low dew point. The "Hygrol" solution resulting is continuously and automatically re-concentrated, providing always full capacity in air conditioning and assuring always a constant dehumidifying capacity and a trustworthy, constant condition for your material, apparatus, process or room to be conditioned.



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Investigate this new Method for "comfort" air conditioning as well as to protect quality in hygroscopic material, or processes or instruments, or to prevent condensation damage to metals, parts or products.

Write for Bulletin No. 112

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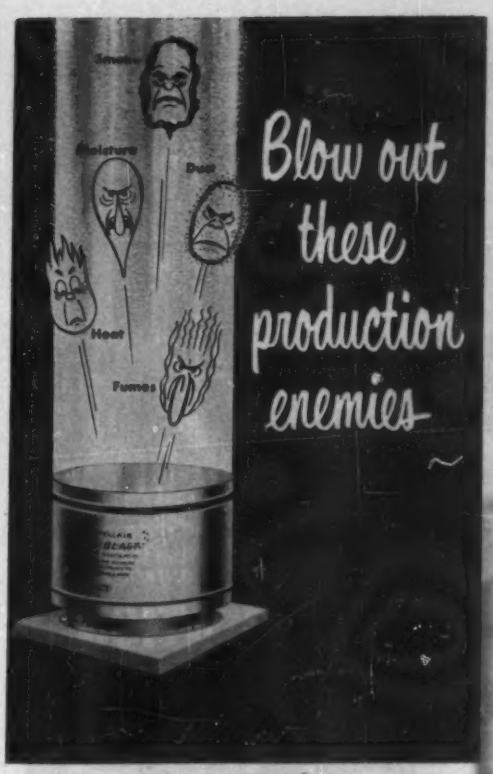

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Equipment for Air Conditioning, Handling and Cleaning

HPAC 101—Booklet B-5164 is a condensed (16 page) full line catalog giving specifications and capacity data, and describing the special features of air conditioning, air handling and air cleaning equipment — Westinghouse Electric Corp., Sturtevant Division, Dept. T, Hyde Park, Boston 36. Included are conditioning equipment such as unit air conditioners, unit heaters, compressors, condensers and water coolers; air handling equipment, including ventilating equipment and fans (general purpose, industrial, heavy duty and mechanical draft); and electronic air cleaning equipment such as the "Precipitron", horizontal, vertical, and encased air cleaners, and an oil mist control unit.

Alloy Welding Electrodes

HPAC 102—Bulletin AR51-1 covers alloy welding electrodes used for defense production — Alloy Rods Co., York, Pa. It discusses the development and uses of armor welding electrodes; electrodes for corrosion resistance, high temperature applications, and special purposes; and low hydrogen ferritic electrodes.

Alloy Welding Rods

HPAC 103—Five bulletins cover a line of hard facing alloy welding rods — Victor Equipment Co., 844-54 Folsom St., San Francisco 7. Four of the bulletins cover tungsten carbide rods (one of them a fine mesh type) for electric or acetylene application; and one covers a fabricated rod, containing alloys in a tube, which is designed to withstand abrasion and severe impact.

Ammeter-Voltmeter

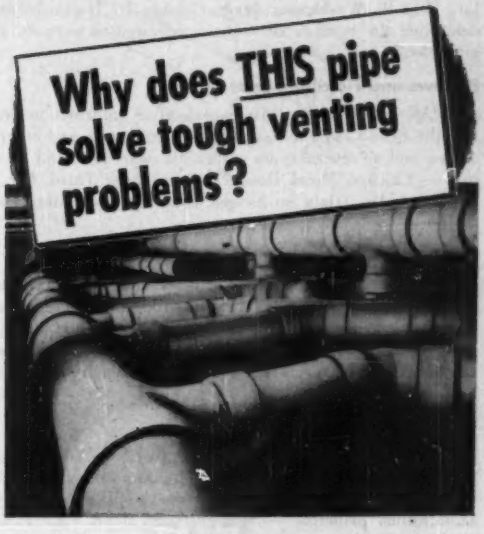
HPAC 104—Manual 504 is a collection of "case histories" on the use of the "Amprobe Snap-around Volt Ammeter" in various servicing jobs — Pyramid Instrument Corp., 49 Howard St., New York 13. The instrument is an a-c ammeter and voltmeter in one unit.

Amplifier-Motor Combination

HPAC 105—Bulletin B15-12 describes the circuit and discusses component characteristics of the amplifier and motor combination of the "Electronik Continuous Balance System" used in potentiometers, Wheatstone bridges, and various phases of laboratory measurement — Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Station 40, Wayne and Windrim Aves., Philadelphia 44.

Beam Load Selector

HPAC 106—Pocketsized beam load selector (for users of metal framing), showing the amount of weight which can be supported by various sections under varying conditions of span and unbraced height — Unistrut Products



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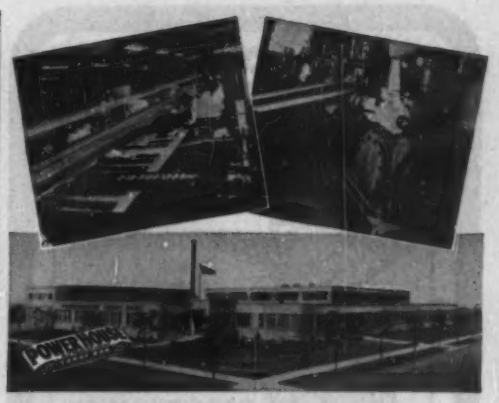

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WRITE FOR NEW CATALOG 43-C

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Co., 1013 W. Washington Blvd., Chicago 7. It also helps determine the number of sections required to support a given load.

Bellows and Flexible Metal Hose

HPAC 107—Catalog (16 pages) gives information on metallic bellows of stainless steel, brass, bronze and other alloys, and on several types of flexible metal hose and tubing — Chicago Metal Hose Corp., 1315 S. Third Ave., Maywood, Ill. Data on flanges, couplings and fittings is included.

Boiler

HPAC 108—Catalog 99 illustrates and describes the "Scottie Junior" boiler for 125 lb working pressure, with oil or gas firing — Kewanee Boiler Corp., Franklin St. and "Q" Tracks, Kewanee, Ill. Ratings and dimensions are listed, and its special uses (for limited headroom, etc.) are outlined.

Burners for Oil or Gas

HPAC 109—Bulletin (16 pages) discusses advantages of oil as a fuel (alone or in combination with gas), and special features of oil burners operating on the dry atomization principle — Lammert & Mann Co., 1753 Walnut St., Chicago 12. Various models are shown (for oil or oil-gas, cylindrical or high set firebox, and wide or low firing), and typical installations are illustrated.

Cast Monel

HPAC 110—Reprint of a recent magazine article, *Uses Broaden for Cast Monel*, discusses the care that must be taken in melting monel, its acid resistant properties, and its weldability — The Cooper Alloy Foundry Co., Bloy St. & Ramsey Ave., Hillside, N.J. Tables give data on its mechanical and physical properties, and resistance against various acids, neutral and alkaline salts, acid salts, wet and dry gases, organic materials, etc.

Corrosion Resistant Alloys

HPAC 111—Materials selection chart compares the suitability of carbon steel, two stainless steel alloys, a nickel-chromium-copper-molybdenum alloy, and other alloys, for handling a variety of corrosives — The Cooper Alloy Foundry Co., Bloy St. & Ramsey Ave., Hillside, N.J.

Electric Contact Controllers

HPAC 112—Catalog 8000 illustrates and describes vane type electric contact control units to be used with thermometers, pressure gages, potentiometers, and millivoltmeters, and designed to give snap action, on-off, two or three position control — Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Station 40, Wayne and Windrim Aves., Philadelphia 44.

Enclosed Ammonia Compressors

HPAC 113—Bulletin 112-I covers the general and special features, applications, and principles of refrigeration of enclosed ammonia compressors — Frick Co., Waynesboro, Pa. There are sections on capacity controls, dual-pressure machines, and lubrication and drives. Four basic models are shown, and space requirements are diagrammed.

Expanded Metal Meshes

HPAC 114—Catalog (24 pages) gives specifications, and describes applications of expanded metal meshes in carbon

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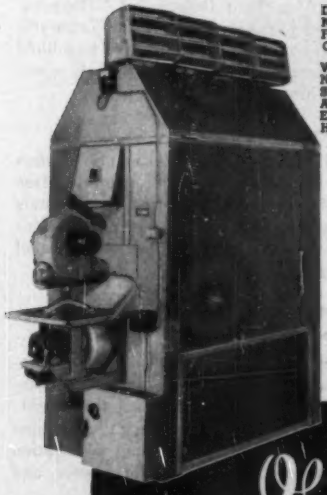
OLSON, THROUGH THE USE OF A SEPARATE INDUCED DRAFT FAN, ELIMINATES THE OBJECTIONABLE COLD AIR BLAST AT EVERY START. PERSONNEL DIRECTORS SAY THAT THIS FEATURE IS ESPECIALLY APPRECIATED BY EMPLOYEES.



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WHATEVER YOUR NEED, LARGE OR SMALL, OLSON IS THE ANSWER TO LOW COST EFFICIENT SPACE HEATING.

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PRESSURE BLOWERS

FOR SMALL EXHAUST SYSTEMS AND FOR CONVEYING, COOLING, ETC.

PRODUCE A LARGE VOLUME OF AIR AT HIGH STATIC PRESSURES

● Peerless Electric pressure blowers are designed to produce a large volume of air at high static pressures with the advantages of a self cleaning paddle wheel.

These blowers are recommended for small exhaust systems where air is laden with dust or grit, and also for supplying high pressure air for conveying, cooling, etc.

The blowers are made in four sizes, with motors of ½, ½, ¾ and 2 H. P., and wheels 7¾ x 2, 9 x 2½, 10¾ x 2½, and 12½ x 2½, respectively.

WHEELS—Constructed with straight radial blades supported on a heavy back plate with heavy cast-iron hub, dynamically balanced and designed for efficient operation.

HOUSINGS—Arc-welded 16-gauge steel housings and motor bases for rigidity and long life.

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CAPACITIES—Tested and rated in accordance with codes adopted by National Association of Fan Manufacturers and the American Society of Heating and Ventilating Engineers.

GUARANTEE—Units are guaranteed against defective workmanship or material for a period of one year from date of shipment from factory. Each unit when shipped is registered and the serial number identifies it immediately for spare parts or duplicates.

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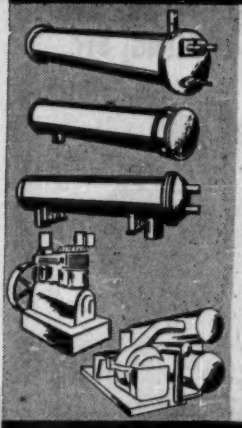

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CONDENSERS AND
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Air Velocity
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Low Velocity Range: 0-750 fpm
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Based on the hot thermopile principle, the AGITAIR Meter gives instantaneous accurate measurements of air velocities as low as 5 fpm, and as high as 4000 fpm. It is inherently stable, does not waver or jerk and unlike many resistance type hot-wire instruments it is free from errors caused by temperature variations, radiation effects and lead resistance. For taking static pressure readings from 0 to 4" wg, a special attachment is provided. The simplicity and utility of the AGITAIR Meter make it useful for many diverse applications.

Write for Bulletin AM-100

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Air Diffusers • Air Filters • Exhausters

steel, aluminum, stainless steel, monel, and other metals — Penn Metal Co., Inc., 205 E. 42nd St., New York 17.

Fin Pipe Radiator

HPAC 115—Bulletin K-502 describes fin pipe radiators featuring a notched flange made of tempered steel, which enables the fin to expand and contract during the heating cycle — Slant-Fin Radiator Corp., 5113 Second Ave., Brooklyn 32. Ratings and sizes are given for the heating elements, and a correction factor chart and complete piping data are included. Various types of top covers are illustrated.

Heat Exchanger

HPAC 116—Bulletin 120 describes the "Aero" heat exchanger for use in metal working, electric and process industries — Niagara Blower Co., 405 Lexington Ave., New York 17. Diagrams illustrate operation of the balanced wet bulb control, and typical applications are shown.

Heat Exchangers

HPAC 117—Catalog 1313 (4 pages) describes a new line of heat exchangers, suitable for either "Freon 12" or "22," and available in eleven models with capacities of from 3 to 200 tons — Acme Industries, Inc., Jackson, Mich. General specifications, dimensions, and selection data are supplied, and curves are given for superheat performance, suction gas pressure drop and correction multiplier for the pressure drop.

Heat Insulation

HPAC 118—Bulletin (12 pages) describes "Custom-molded" light density 85 percent magnesia pipe and block insulation, for heat ranges up to 600 F — Mundet Cork Corp., 7101 Tonnelle Ave., North Bergen, N.J. The process of manufacture and physical characteristics (compressive strength, etc.) are outlined. Tables give simplified thickness standards for pipe covering, and there is a section on data for heat transfer calculations.

Heaters and Convectors

HPAC 119—Catalog 29g describes steam unit heaters (propeller fan and blower fan types), convectors (free standing and partially recessed), and direct fired heaters (oil or gas) — Airtherm Mfg. Co., 711 S. Spring Ave., St Louis. Capacity tables are given, and each type of equipment is illustrated.

Indicating Pyrometers and Resistance Thermometers

HPAC 120—Bulletin 1051 describes a new line of non-control pyrometers and resistance thermometers — Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Station 40, Wayne and Windrim Aves., Philadelphia 44. Included are wiring diagrams and circuit information on pyrometer, resistance thermometer, tachometer and other actuations.

Insulation for Pipes and Equipment

HPAC 121—Bulletin 4h covers "Thermalite" 85 percent magnesia insulation, combination pipe insulation, high temperature blocks, sponge felt, wool felt, other insulations, and cements for insulating and finishing. Ehret Mag-

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MUCKLE VENTS

Take a look at the new silhouette . . . . it's low slung and streamlined — better looking on any roof!

Get away from old, "eye sore" ventilators — get the newly designed Muckle Vents. Engineered for better performance in moisture laden air — the motor is out of line of air flow. A compact, good looking, easy to install all-in-one unit to fit any roof.

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Muckle MANUFACTURING CO. OWATONNA 8, MINN.

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HX-CHANGERS solve many problems of heating and cooling liquids and vapors

Illustration shows HX-CHANGER with end exposed.

Standard units for

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- Converting air-cooled compressors to water-cooled service.
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- Water chiller using refrigerant as cooling medium.
- Cooling lubricating and cutting oils using refrigerant.
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Fig. 3640 Close-Cupld Centrifugal

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We're all interested in ways of saving money. Your air conditioning customer is no different. He'll be pleased if you can point out how little power is used by his air conditioning installation.

To keep power consumption low, use a Goulds pump in your air conditioning unit. Careful engineering, top-grade materials, and skilled workmanship are combined in Goulds pumps. They operate year after year at top efficiency—lowest power input for the job done, and long years of perfect service.

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Low Cost
Fast Work
Leakproof
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IT'S THIS EXCLUSIVE RECESSED BRASS SEAT that means JOINTS THAT STAY TIGHT

. . . when you use JEFFERSON SPECIALTY UNIONS

*Made from malleable iron with tensile strength of 55,000 lbs. per sq. in.—they won't fail.

*Rings are cut from a special brass tubing—they're *not* cast.

*Ring channels are *machined* rather than cast—no rocking of the seat.

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These are just a few of the reasons why you should investigate our unions for your piping assemblies. We're sure you'll find them to be the solution to your piping problems.

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CHROMALOX
Electric
UNIT HEATERS

THE HEAVY DUTY BLOWER-TYPE SPACE HEATERS
for PORTABLE or PERMANENT COMFORT HEATING

For complete data on Space Heating electrically for your needs.
WRITE FOR CATALOG 50

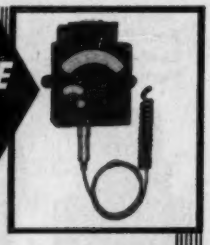
Now it's easy to heat the smallest office or largest shop to a comfortable level in coldest weather with Chromalox Electric Unit Heaters. Units are available for portable use or permanent mounting to walls and ceiling, and only Chromalox gives you famous Chromalox Heating Elements. Motor driven fans assure positive air circulation which eliminates cold spots. On larger models, ducts can be used to convey heated air to desired areas. Automatic thermal cutouts assure protection against overheating.

IB-18

Industrial Div., EDWIN L. WIEGAND CO., 7610 THOMAS BLVD., PITTSBURGH 8, PA.

CHROMALOX
ELECTRIC HEATING AT ITS BEST!

NEW TYPE CI
ADJUSTABLE THERMOSTAT



The new Type CI Adjustable Indicating Thermostat is a precise temperature control for gas, liquid, and metal-to-metal applications, such as ovens, hot plate presses, water baths, incubators, proofing cabinets and cold cabinets. It is most useful on units where periodic checks of temperature are required, advisable, or will prove time-saving. The new Type CI is simply and ruggedly built, employing the highly sensitive response action of a solidly liquid-filled bulb and bellows assembly to a snap-acting switch and indicating pointer. The thermostat is adjustable over its entire range by a knurled thumbscrew on the front of the case.

SPECIFICATIONS:
Case 5½ x 5½ x 1¾"; Wt. 3 lbs. Standard ranges 50°—350°F and 50°—600°F, special ranges may be had between —120°F and +600°F. Standard differentials ½°F in circulating liquid, 2°F in air. Switch ratings 10 amp. 125 V AC and 5 amp 250 V AC. Write for new bulletin No. 4816T which gives full details.

UNITED ELECTRIC CONTROLS COMPANY
87 School Street
Watertown, Mass.

STANDARD & SPECIAL THERMOSTATS & PRESSURE SWITCHES

nesia Mfg. Co., Valley Forge, Pa. Recommended insulation thicknesses are given for pipes and equipment, and application procedures are discussed.

Low Temperature Refrigerant

HPAC 122—Booklet describes "Kulene-131" (bromo trifluoro methane), a non-toxic, non-explosive, non-inflammable condensable gas suitable for use as a low temperature refrigerant — Eston Chemicals, Inc., 3100 E. 26th St., Los Angeles 23. Special features are a low compressor displacement, low compression ratio, and operating pressures sufficiently high to permit operation of low temperature equipment. Tables give temperature, pressure, volume and density relationships; and temperature, heat content and entropy relationships.

Measuring Circuits Used in Potentiometers

HPAC 123—Bulletin B15-13 discusses the characteristics of the measuring circuits used in the "Electronik" potentiometer — Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Station 40, Wayne and Windrim Aves., Philadelphia 44.

Motor Driven, Controlled Volume Pumps

HPAC 124—Bulletin 251 illustrates and describes standard and special motor driven controlled volume pumps for a wide range of liquids, including heavy viscous liquids and light solvents, solids in suspension, abrasive slurries, hot or cold liquids, liquefied gases, etc. — Milton Roy Co., 1300 E. Mermaid Lane, Philadelphia 18. Details are given on plunger speed and adjustment, and capacity pressure selection tables are included.

Motors

HPAC 125—Bulletin MU-94, No. 15, describes special features and applications, and gives ratings of polyphase squirrel cage motors (electrical types, enclosure types, and multispeed motors), wound-rotor polyphase motors, single phase motors, gear motors, and direct current motors — Wagner Electric Corp., 6400 Plymouth Ave., St. Louis 14. Information also is given on an increment type motor and starter combination, and a dry type transformer.

Non-Resonant Pipe Hangers and Sway Braces

HPAC 126—Catalog 502 covers non-resonant variable support hangers, with damping features, designed to avoid resonance no matter what frequency of vibration is impressed, and non-resonant sway braces, designed to prevent sway and control horizontal vibration without confining the natural thermal movement or adding stresses — Bergen Genspring Corp., Dept. 18, 50 Church St., New York 7. Load deflection charts are given for the hangers (available for 1½ and 3 in. travel range), and for the sway brace, which is furnished in nine sizes, with initial loading ranges of 92 to 1500 lb. Complete specifications are given for all hanger models.

Package Pumps

HPAC 127—Bulletin 52B7529 gives capacities, dimensions, performance curves, etc., for fractional horsepower package pumps in capacities to 80 gpm and heads to 100 ft — Allis-Chalmers Mfg. Co., 1171 S. 70th St., Milwaukee. The four available types (open and closed impeller close-coupled, pedestal-mounted, and open impeller vertical mounting) are described and illustrated.

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Well-ventilated working environments contribute to faster, better defense production.

Western Rotary Turbine Ventilators provide constant, round-the-clock exhaust *without power*. A 2-mph breeze keeps your Western Rotary System in operation. Lifetime guaranteed bearings are both mounted on the same axis . . . always stay in alignment. Throat sizes 6" through 48", with the clean, low silhouette progressive industry demands.

Complete, up-to-the-minute information, sizes, capacities, and prices on all Western equipment upon request. In 1951 SWEETS and A.E.C. AVAILABLE FROM YOUR FAVORITE WHOLESALER'S STOCK.

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Fuel shortages or failures always pick the very worst time to occur SIEMON COMBI-MATIC Oil and Gas Burners will increase sales for you by eliminating many headaches for both you and your customers and assuring dependable, completely automatic, economical heat. Write today for complete information about this amazing new burner.

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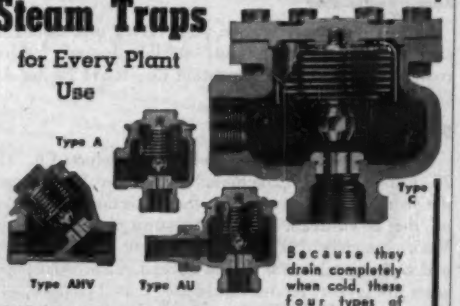
FREEZE-PROOF Steam Traps

for Every Plant Use



Because they drain completely when cold, these four types of Nicholson steam traps are positively freeze-proof. Can be freely installed outdoors. Universally recommended for use in lines which need not be in continuous use during cold weather, because they are freeze-proof and because their 2 to 6 times average drainage capacity results in minimum heat-up time. The non-air-binding feature of Nicholson traps also notably facilitates heat transfer in severe weather. Sizes ¼" to 2"; pressures to 225 lbs.

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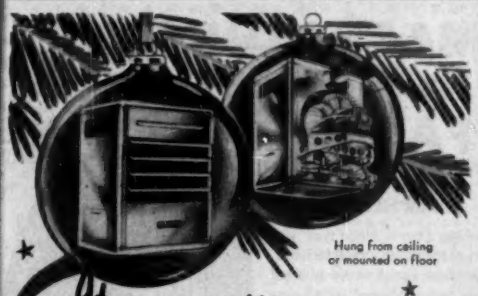

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HPAC 128—Catalog EL-16 gives specifications and installation data for the various types of "Electriglas" radiant heating panels (tempered glass, with a chemical heating element fused into the back surface) — Appleman Glass Works, Bergenfield, N.J. Covered are baseboard panels, units with built-in line voltage thermostats, standard, and high panels.

Pipe Coils

HPAC 129—Catalog 26-B covers various types of pipe coils, such as spiral, rectangular, flat, oval and double — Acme Industries, Inc., Jackson, Mich. General specifications, bending data, and tables of heat transfer coefficients are given, and a selection procedure is outlined.

Radiator Shields and Enclosures

HPAC 130—Folder describes and illustrates radiator shields and enclosures with insulation and aluminum foil on back and underside of top designed to assist air circulation by reflection — Kauffman Radiator Shield Co., 4505 Olive St., St. Louis 8. Illustrated is a dust gutter at the front end of the shield, which catches 90 percent of the dust circulating through the radiator, the manufacturer states.

Registers, Grilles and Diffusers

HPAC 131—Catalog 52 a.c. covers air conditioning registers and grilles (three series, for baseboard and sidewall use), ceiling diffusers, perimeter diffusers, perimeter baseboard registers and grilles, damper control sets, gravity registers, return air intakes, ventilators, etc. — Air Control Products, Inc., Coopersville, Mich. Also featured are new visionproof grilles for doors, partitions and return air intakes. Types of ventilators included are roof, triangle, foundation, thru-the-wall, and cement block. Engineering data is given throughout, and there are selection data tables for registers and grilles.

Roof Ventilator

HPAC 132—Specification sheet gives dimensions and capacities of the "Whirlout" straight-through, powered roof ventilator — The Swartwout Co., 18511 Euclid Ave., Cleveland 12.

Safety Relief Valves

HPAC 133—Marine and Industrial Products Co., 3731-35 Filbert St., Philadelphia 4—Bulletin 851 discusses the sizing of safety valves for the protection of equipment on the downstream side of pressure regulating valves. Various models of the company's safety valves are shown, and capacity tables for steam, air and gas at various pressures are given. Also included are general charts showing the steam and gas capacity required from safety valves to give complete protection in case of pressure reducing valve failure.

Silver Brazing

HPAC 134—Pocketsized manual (48 pages), *Complete Guide to Successful Silver Brazing*, treats questions of low temperature silver brazing, brazing alloys, joint design, preformed brazing shapes, fluxing, etc. — American Platinum Works, 231 New Jersey Railroad Ave., Newark. Charts give conversion data, U.S. Government specifications, and brazing alloy quantities by weight.

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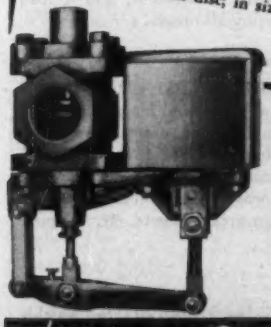

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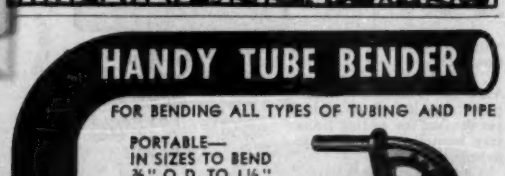

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HPAC 135—Bulletin discusses special features and applications of steam generators (in 18 sizes from 20 to 600 bhp), giving specifications of boiler equipment, and burner equipment for gas and/or oil — Superior Combustion Industries, Inc., Times Tower, Times Square, New York 18.

Steam Traps

HPAC 136—Bulletin HC-51 gives information on bourdon tube powered steam traps, including low, medium and high pressure traps, and drip, boiler return, and float vent traps — William S. Haines & Co., Inc., 1010 Wood St., Philadelphia 7. The principles of bourdon tube actuation are outlined.

Steam Traps for Unit Heaters

HPAC 137—Volume 20, No. 5, 1951 issue of *Trap Magazine* is a guide to the selection of steam traps for unit heaters, by the Btu and condensate methods — Armstrong Machine Works, Three Rivers, Mich. Trap selection for heaters operated at constant and variable pressures is covered. Manufacturers' Btu output ratings for 30 makes of heaters, recommended installation practices, physical data and list prices of the company's traps for unit heaters are included.

Totally Enclosed, Fan Cooled Motor

HPAC 138 — Bulletn 51B7225 gives construction details of totally enclosed, fan cooled and non-ventilated motors for applications involving dust, dirt, corrosive gases, etc. — Allis-Chalmers Mfg. Co., 1171 S. 70th St., Milwaukee. Dimensions and ratings are tabulated.

Variable Support Pipe Hangers

HPAC 139—Catalog 501 covers a line of variable support spring hangers (for piping subject to positional changes resulting from the thermal expansion of the supported equipment) with load-travel ranges of 1½, 3, and 6 in. — Bergen Genspring Corp., Dept. 18, 50 Church St., New York 7. In each travel range, there are models for use where headroom is limited, where the spring unit is set above the supporting member and the pipe suspended below, where piping is supported from below, etc. For each model, data is tabulated as to sizes, rated load, approximate weight, and housing dimensions, and a load deflection chart is given covering all ranges.

Water Columns and Gages

HPAC 140—Bulletin WG-1811 (1951 edition) covers "Yarway" water columns and gages, and incorporates new details on flat glass inserts for high pressure gages — Yarnall-Waring Co., 107 Mermaid Ave., Philadelphia 18. Included are detail on floatless alarm water columns, vertical or sesure-inclined water gages, illuminators for flat glass gages, column-gage arrangements, etc. Typical installations are shown.

Welding Accessories

HPAC 141—Catalog EW-164-S describes headshields, electrode holders, cleaning tools, ground clamps, and other equipment in a complete line of welding accessories — Hobart Brothers Co., Box EW-164, Troy, Ohio.

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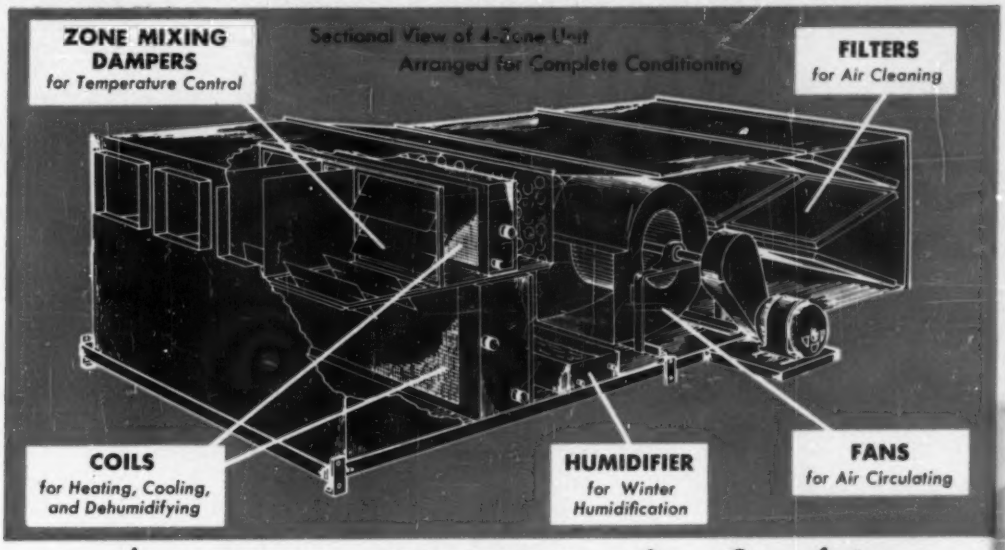
Blow-Thru MULTITHERMS



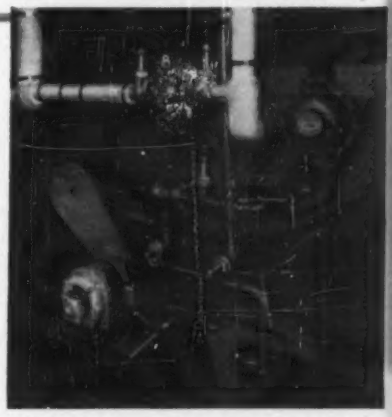
for ZONE CONTROL *Air Conditioning*

Different Temperatures and Humidities at the SAME Time with ONE Unit

One Clarage Blow-Thru Multitherm can be used to air condition various parts of your building exactly as your requirements warrant.

ZONE CONTROL compensates for the difference in solar radiation on different parts of a building during different times of the day. It also takes into account variations of exposure, wind velocity, construction, and different internal heat loads.

Thus winter and summer, if desired, you can maintain *different temperatures and different humidities* in various parts of your building. Each zone is automatically and independently controlled — yet only ONE Clarage Blow-Thru Multitherm required.



This 3-zone Blow-Thru Multitherm unit air conditions the 2-story office building of the Northern Indiana Brass Co., Elkhart, Indiana. Installation made in December, 1940.

CLARAGE
—HEADQUARTERS for Air Handling and Conditioning Equipment

NEW BULLETIN 1310 gives descriptive details, specifications, capacities, and dimensions. Send for your free copy today.

CLARAGE FAN COMPANY
KALAMAZOO, MICHIGAN

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

If the auto boys sold the boilers...

Well . . . maybe the auto boys wouldn't carry it quite this far. But just take it the other way around: Suppose the heating men sold the automobiles. Isn't it a fact that some of the cars they delivered would be stripped right down to their bare hide?

Now don't get us wrong: we are not suggesting that you "load" boilers with things the boiler owner doesn't need. But just remember this: When a boiler owner tries to tell you he doesn't need this and that, keep in mind that he's the very same fellow who is now married to a lot of auto accessories he *once* thought he didn't need.

Yes, you can take a leaf from the auto dealer's book — if not a full leaf, at least part of a leaf. At least see that the boiler owner gets everything he *should* have!

Certainly the number one "should" is the device that safeguards the boiler from low water. The best form for it to take is the McDonnell No. 47 (for the smaller heating boilers) or the No. 51 for the larger boilers . . . with No. 2 emergency low water cut-off switch of course, if the boiler is automatically fired.

Ask for new catalog covering boiler feeders, low water cut-offs and safety relief valves for all conditions.

McDONNELL & MILLER, Inc. 3500 N. Spaulding Ave., Chicago 18, Ill.

Doing One Thing Well

Your Jobber Stocks Them

McDONNELL

Boiler Water Level Controls

McDonnell No. 47-2

No hand-fired steam boiler should be without the No. 47 Boiler Feeder — no automatically-fired boiler without the No. 47-2 feeder cut-off combination. Constantly improved year after year, the No. 47 is the last word for boilers up to 5000 sq. ft. capacity; maximum steam pressure, 25 lbs. Other types for larger and higher pressure boilers.

McDonnell No. 67

Next best thing to the No. 47-2 for the automatically-fired boiler is the No. 67 Low Water Fuel Cut-off. It is for boilers of any size; maximum pressure, 70 lbs.

McDonnell No. 150

For those higher pressure boilers (maximum, 150 lbs.) the No. 150 is the answer. It controls the feed pump directly from the boiler water level; also provides low water fuel cut-off and low water alarm when desired. Same control made with integral water column for easy installation — the No. 157.